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STUDYING STREET-LIGHTING COSTS.

It is a question if any subject in the field of public-utility relations so easily falls a prey to political speculation as does street lighting. The price of this service is an early target whenever a typical municipal campaign in the supposed interests of the proletariat gets under way, and probably as much misinformation is spread about on this subject as on any other which is of electrical interest from the standpoint of public affairs. With modern lamps, the proportion of the plant investment required to handle the street-lighting load is comparatively small, and the total revenue from this source is in most cases greatly exceeded by the income from commercial lighting and power. The business is valuable, however, because of its long-hour characteristics, and in view of this fact the demands of municipalities that prices reflect this favorable condition are not wholly unreasonable.

The contention that reduced prices stimulate gross business is not necessarily directly applicable to street lighting, however, and a reduction in price, while to some extent encouraging its extension, may result in a corresponding decrease of revenue. This is a very important point to bear in mind in discussing prices of this kind. Each case must be treated on its merits, but the best opinion today seems to be that central stations should be allowed to make prices sufficient to cover the so-called fixed costs of the service, including a fair return upon the street-lighting investment, and also to meet the operating expenses and repairs of this portion of the system.

The rate per kilowatt-hour should preferably not exceed the maximum net price charged private customers. In other words, where differential prices to private customers are freely made for different uses because of corresponding differences in load-factor, the city with respect to its street lighting seems entitled to like consideration. The length of contract obviously enters into this determination and nothing could be more unfair than to require a company to quote practically the same prices for a short-time as for a long-time agreement in this field, where so much of the equipment is absolutely worthless for any other service. The final price as fairly regarded from the engineering standpoint, may be determined by balancing the advantages of a good load-factor against the investment and maintenance costs peculiar to the service. This in effect is being done in many cases where the growth of a city and consequently increased number of lamps in service justifies the company in making some reduction from the old prices,

while very properly restraining it from accepting sharp cuts in rates based upon a fictitious supposed increase in service resulting from such a reduction. Studies leading to the segregation of investment and operating costs in street-lighting systems are well worth making with as much detail as time permits, where the rates for this class of service are likely to come in question.

THE ENGINEER IN PUBLIC SERVICE.

We are glad to note that at its meeting next December, the American Society of Mechanical Engineers is to devote a session to the subject of "The Engineer in Public Service." It is coming to be recognized that engineers as a class have not occupied the position which they ought to occupy with respect to engineering questions which come up in relation to government and community matters, especially where they are involved in any political way. This was emphasized by Mr. Ralph D. Mershon while president of the American Institute of Electrical Engineers two years ago, and was also touched upon by the present president, Dr. C. O. Mailloux, in his recent presidential address at the Detroit convention. It has frequently been referred to in other quarters of late and has come to be particularly recognized since the advent of the public-utility commissions which have been established by so many of our states. Engineers recognize that the work of such commissions is largely involved with engineering questions, which should be in the hands of engineers for decision. While appointments of engineers to such commissions have been made, the frequency of such appointments is entirely out of proportion to the requirements for engineering knowledge and engineering training in such matters.

The reason for such lack of recognition of engineers lies no doubt in their failure both as individuals and in their organizations to take the interest and the initiative in community affairs which their abilities would warrant. The engineer has been brought in too generally as a subordinate or an adviser rather than as an executive and administrator. There is a tendency too for the engineer to avoid duties of the latter character and confine his attention too closely to the purely technical questions involved. Our contemporary, *Engineering*, of London, has aptly said in this connection:

"It cannot be denied that many engineers are inclined to become too much absorbed in the purely technical aspect of engineering, and to regard their profession a little too much from a standpoint which, though perfectly legitimate in the case of a physicist, is improper in the case of men whose labors are expected to contribute directly and immediately to the wealth of the world. An engineer—and examples are not uncommon—who interests himself solely in the scientific aspect of his profession undoubtedly greatly reduces his opportunities of benefiting his kind, and often is indirectly responsible for much wasteful expenditure. The complaint, for instance, is often made that funds appear to be easily found for the financing of engineering schemes of the most impossible and impracticable character, whilst really reasonable schemes go begging. Were those responsible for the latter better acquainted with the ways of business men, there would be a fair chance of diverting into productive channels resources which are now just as absolutely wasted as if they were invested in a timber yard and immediately fired."

A discussion of the relation of the engineer to public matters is highly desirable and no doubt much interest will be taken in it. It should result in a more direct interest being taken by engineers in public affairs, and in associated action on their part which will lead to greater recognition of the engineer by the public as an authority in his own field. At present, he is not looked upon in the same way in which members of the medical and legal professions are regarded in their fields.

EXPEDITING COMMISSION PROCEDURE.

If the regulation of public utilities by state commissions is to attain complete success, everything possible must be done to eliminate delays in the findings of such boards upon pending petitions. In a recent instance a highly respected board of nearly 30 years' experience took substantially two years to hear and decide an electric lighting rate case in a small inland city, and considerable popular dissatisfaction was aroused as a result. Toward the end of the case the city government voted to ask the commission if a decision might not be expected at an early date, and when the order finally came, the decision of the board on local gas rates, also involved in the petitions, was withheld for further study. The electric rate decision reduced existing prices to an extent which will save the public something like $10,000 per year, but as the decision was not retroactive, although based upon statistics of the year ending June 30, 1913, the company was the gainer by the delay.

Delays of this kind work both ways, and it is to the advantage of all parties that a case shall be cleared off a commission docket as soon as possible. In the instance in mind, the board was only partly responsible for the length of the proceedings. Nine months elapsed between the opening and the closing hearing, although the case was not one of extreme complication. Postponements by counsel were a factor in the delay, as was the almost overwhelming amount of new business forced upon the board, some of which threatened its very life as a power in corporate regulation. It is more profitable to consider what can be done to avoid delays of this kind than to dwell at length upon the reasons for past sins of omission, and in looking into this matter, there are some very practical points in co-operation to be emphasized.

Full preparation on the part of the company for answering questions arising at hearings, a willingness to be entirely frank regarding every phase of management, and entire avoidance of obstructive tactics with respect to the presentation of data legitimately required will do a great deal to shorten the number of hearings required in cases in which profound legal and particularly constitutional questions are not involved. In states where

a large amount of court work has to be done on behalf of a public utility, it may be desirable to divide the legal work between courts, commission and legislature, retaining different counsel for each of these important fields of service. Conflicting engagements otherwise tend to prolong the hearings to inordinate lengths in companies of large scope and influence.

On the part of the municipality or group of consumers usually concerned in commission proceedings, time will always be saved by entrusting the case to an experienced adviser blessed with a broad and liberal mind, and if petty politics can be kept out, all the better. As for the commission itself, it is safe to say that in too many cases too great emphasis is laid upon hearing evidence by the full board in person, and again, the staff is often too small to enable the work of regulation to be handled with promptness. The size of the commission and its staff should naturally be governed by the amount of business to be dealt with, but sometimes, as in the case above in mind, little provision has been made for handling heavily increased duties, the board being obliged to struggle along with a docket of overwhelming size and to accomplish the impossible task of being all things to all men.

Money expended on stenographic reports of proceedings is well invested where all the members of a board are hard pressed with duties, and certainly it is not too much to expect that the members of such boards, in states where the volume of business is great, should be required to give all their time to the work of their offices and not to attempt to carry on private professional or commercial work while the docket of the commission remains uncleared. It is well known by close observers of commission practice that much of the best work of such boards is done in informal conferences outside of public hearings, and in view of the progress which is usually made in this way, it would seem that postponements of public hearings ought not to stand in the way of a reasonable expedition of cases.

THE NORWICH SYSTEM OF RATES.

We publish in this issue a portion of a paper presented before the Incorporated Municipal Electrical Association at Birmingham last month by Mr. J. Horace Bowden. Among other methods of charging for electric energy, this discusses the Norwich system, which has been much advocated in England, although little known in this country. It is characterized by a fixed charge proportioned to the taxes (known in England as "rates") paid upon the property served, and has, we believe, been applied chiefly to residences. It should be remembered that taxes in England are based upon rents received (or estimated value, when not actually rented) rather than upon an appraised valuation of the property itself, so that idle property is not taxed. Mr. Bowden shows clearly that rateable value bears only a slight approximation of proportionality to actual demand, and gives his own views as to an appropriate method of formulating a system of rates.

OBLIGATION OF A UTILITY TO SERVE ALL.

An important decision has been handed down by the Appellate Division of the New York Supreme Court regarding the obligations of utility corporations toward the public. The suit was instituted by a resident of New York City who was using power from a private plant during certain hours, and applied to the New York Edison Company for service. The latter refused to supply current unless the applicant would contract to take from it all the current which was required. The Public Service Commission upheld the attitude of the company, but the court has given a unanimous decision holding that the company is bound to serve any one who demands its services. While reasonable regulations may be provided, it is held that a requirement that the customer purchase all of the necessary current from the company is a purely arbitrary attempt to secure greater business for itself.

This decision is in line with the decisions of other courts which have passed upon similar questions, and it would seem indeed strange if any other attitude had been taken by the court. From the nature of its position the public utility has the duty to serve all who require its services and to any extent that they may require. Courts in this country have ruled against requirements that service of one kind by a utility company might be conditioned upon service of another kind, and in England a decision was recently handed down obligating an electric utility to furnish current for power, even though a customer insisted upon using gas for lighting purposes.

While it is natural that an electric company should desire to supply all the current that is used by a customer, and while the privilege of the customer to utilize more than one source may seem subject to abuse and to imposition on the company by using current only at the time of peak load, for instance, the company has protection for itself in its right to charge the maximum rate to such customers. The customer of this kind may be no more undesirable than others having no alternative service. They should, of course, be required to pay for what they receive in readiness-to-serve, as well as energy consumed. It is in cases like this that a demand charge meets the situation so nicely and is an appropriate means of making a customer pay for service which he demands the privilege of using or not using, according to his own desires.

The burden on the central station of carrying such a customer is not greatly different from that of one requiring breakdown service, and it has been customary to supply service of this character. The fact that a breakdown customer uses current frequently should not make him any less desirable a customer.

The position of the New York Edison Company in this case seems to have been untenable and it is remarkable that the Public Service Commission did not order service in the first instance. The lesson to be drawn is that utility companies must be prepared to furnish service to all who desire it.

New Officers of Canadian Electrical Association.

At the twenty-fourth annual convention of the Canadian Electrical Association, held at Montreal June 24-26, the following officers were elected: president, D. R. Street, Ottawa; first vice-president, D. H. McDougall, Toronto; second vice-president, R. M. Wilson, Montreal; third vice-president, Wills MacLachlan, Toronto; honorary secretary, T. S. Young, Toronto; secretary-treasurer, Alan Sullivan, Toronto. Managing committee, J. S. Gould, G. W. Magalhaes, P. T. Davies, H. G. Matthews, A. E. Dunlop, J. S. Norris, George Kidd, Robin Boyle, W. G. Angus, W. S. Robertson, E. L. Milliken, L. W. Pratt, H. R. Mallison, H. Hulme.

Annual Report of Ontario Hydro-Electric Power Commission.

The report of the Hydro-Electric Power Commission of Ontario, Canada, for 1913, recently issued, shows that the system represents a total capital expenditure of $5,915,725. The Commission has built 15 transforming and 27 distributing stations. It has constructed 357 miles of steel-tower transmission lines and has 198 miles of such lines under construction, distributed as follows: Niagara system, 378 miles; Simcoe, 67; Wasdell's Falls, 65; and St. Lawrence, 45. The number of municipalities served was 28 in 1912 and 45 in 1913; the horsepower distributed increased from 26,788 in 1912 to 38,696 in 1913. The number of consumers of electricity for lights was 33,568 and for motive power 1,399 in 1912; and in 1913 the number had increased to 63,157 for lights and 2,532 for power. Electric power is furnished to municipalities at $15 to $50 a horsepower, and each municipality takes charge of the distribution of power and light to consumers at as low a price as possible. It is stated that by reducing the cost of power and light the Commission has already been the means of saving to the people of the province several million dollars a year.

For the present year the Commission is authorized to expend $5,000,000 in extending its facilities for furnishing energy at cost to municipalities for lighting and power. In addition to the 45 municipalities served last year, more than 100 others have asked for estimates for installing plants for the distribution of electric power to be obtained from the generating works at Niagara Falls and other places. By the end of last year 45 municipalities had installed electric power distributing plants at a total cost of $8,469,197 (of which Toronto expended $3,919,810). The total revenue was $2,605,006.

Electrolysis Survey in Salt Lake City.

A complete test of city water mains, to determine just how much damage has been done and is being done by electrolysis, is to be made at once by the city water department of Salt Lake City, Utah. Several months ago a piece of water main was dug up and was found to have been almost eaten away by the stray electrical currents. It had been perforated in several places. Investigations led the water officials to believe that such damage might be extensive and so it has been decided to make a thorough survey of the entire distributing system in Salt Lake City.

Annual Convention of Telluride Association.

The annual convention of the Telluride Association, which has been in session at Provo, Utah, since June 22, adjourned on July 6, to reconvene at Provo on June 23, 1915. About fifty young men were granted scholarships at Cornell, Princeton, Purdue, Stanford, University of Missouri, and other universities. The following officers were elected for the ensuing year: President, L. G. Nightengale, New York City; vice-president, David Wegg, Jr., Chicago; treasurer and manager, W. L. Biersach, Provo, Utah; secretary, B. Landon, Jr., Chicago; dean, E. A. Thornhill, Boise, Idaho.

St. Paul Electrification.

The St. Paul Railroad has begun the electrification of its terminals at Great Falls and expects to have this work completed by January 1, 1915. For the electrification of the main line, trolley poles and transmission-line poles are arriving and being placed as rapidly as possible. Plans and specifications for the locomotives and the equipment which will be used in the electrification of the main line are now in the hands of the manufacturers. It is expected that by January 1, 1915, there will be actual operation of a part of the road by electric power.

Telephone Company Erects Unique Sign.

In Chase County, Kans., along the line of the Santa Fe Railway, L. F. Duggan, division superintendent of the Missouri & Kansas Telephone Company, has erected a huge sign made of boulders placed in the shape of letters, with a background of green vegetation. The stones are painted white and spell the words "Talk Home—Bell Telephone." The sign is 10 feet high and 225 feet long.

Rejuvenation at the Ohio Electric Light Convention.

There will be a rejuvenation of the Jovian Order in connection with the convention of the Ohio Electric Light Association, at Cedar Point, O., on Thursday evening, July 23. Statesman Thomas F. Kelly, sales manager of the Dayton Power & Light Company, Dayton, will be in charge of the event and plans already made assure a record-breaking occasion.

Electric Fans Promote Horses' Comfort, Health and Efficiency.

What is probably the first installation of electric fans for stable ventilation in the Intermountain country in the West is being made at the stables of the Utah Light & Railway Company, on South Sixth East Street, Salt Lake City, Utah.

For some time past it has been appreciated that the horses employed by this company to supplement its electric truck and motorcycle service were not being handled to the best advantage as far as stable conditions were concerned and that they would be able to do more work if they had better rest. At nights, on holidays, and especially during the warm weather when 35 to 40 head of horses were being stabled, the ventilation was not the best, and flies caused considerable annoyance, although the stable equipment was one of the best in the city.

With the idea of remedying these conditions a trial installation of electric ceiling fans was made late last summer and because of the very favorable results obtained, a permanent installation was authorized this spring. The installation includes two 56-inch four-blade ceiling fans and two 16-inch blowers. All windows and doors have been provided with screens to facilitate ventilation and keep out flies.

Dr. Walter Emms, veterinarian, and E. C. Cathcart, storekeeper for the company, under whose direction the above installation is being made, are very enthusiastic over the results already obtained. The total cost of the installation will be approximately $177, of which $41 is for screens for doors and windows.

The cost of operating this installation on the rates for electric service in force in the city will be less than 40 cents per horse per month, which is surprisingly inexpensive when the comfort of the horses and the extra service they can render is considered.

Already one or two firms operating large horse-delivery installations in the city are considering the advisability of installing electric-fan equipment for better ventilation and the elimination of the fly nuisance.

Utah Electric Show Association Disbands.

The Electric Show Association of Utah at a recent meeting of its board of directors decided to disband and distribute the capital funds and surplus now held in the treasury to its stockholders. This association was incorporated for the purpose of giving an electric show in Salt Lake City, Utah. This show was held and was a highly successful one both from the result-producing and financial standpoints. The stock of the association was subscribed and taken by the various electrical interests represented in the state. A substantial dividend was paid after the first electric show and a surplus left in the treasury to be used in case subsequent shows were given. As a result of the impetus given the sale of electrical appliances by the show, the use of electrical devices has become much more common and the directors have felt that the necessity of giving a show does not exist nearly to the extent now that it did then.

In case it is decided later on to give an electric show it will not be a difficult matter to raise the necessary funds to do so. The central-station companies, manufacturers, jobbers and supply dealers are now convinced that another show could be conducted on an equally satisfactory and profitable basis at any future time.

Dayton Central-Station Picnic.

The annual picnic of the Dayton Power & Light Company's employees was held Wednesday, July 8, at Kil Kare Park, near Dayton, O. There was an attendance of about 600 persons and everybody had a fine time. Special cars were run to the park on a 15-minute schedule. A regular course dinner was served at noon, with a buffet lunch in the evening. There were baseball games, contests of all kinds and plenty of prizes to make everyone happy. The evening was devoted to dancing.

Westinghouse Strike Ended.

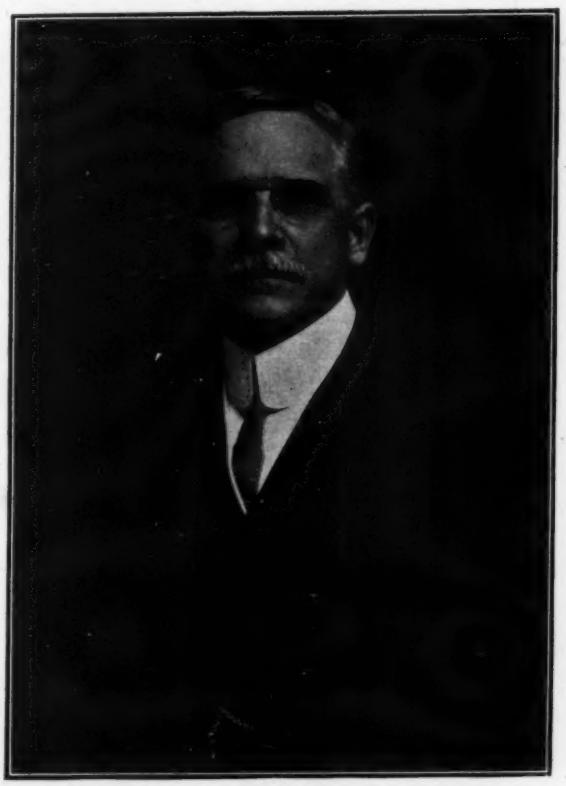
The striking employees of the Westinghouse Companies at East Pittsburgh, Pa., voted on July 9 to go back to work. While the date set for the return to work was July 13, a large number of the men returned on the Friday and Saturday preceding. The works are now running full time.

Charles A. Terry.

Charles Appleton Terry, vice-president of the Westinghouse Electric & Manufacturing Company, was born at South Weymouth, Mass., March 2, 1858, the son of James Pease and Catherine A. (Matson) Terry. He was educated in South Weymouth grammar school, Lyme High School, Norwich Free Academy; he received the degree of Bachelor of Arts from Amherst College in 1879, and the degree of Bachelor of Laws from Columbia Law School in 1883.

Mr. Terry entered the office of Franklin Leonard Pope, 32 Nassau Street, New York, in the summer of 1880. In 1887 he became a member of the firm of Pope, Edgecomb & Terry. He moved to Pittsburgh in 1888 to take charge of the patent department of the Westinghouse Electric & Manufacturing Company. In 1892 he returned to New York, having general charge of patent and legal matters of the company. From April 4, 1891, to February 5, 1909, he was secretary of the company, and he became vice-president on January 19, 1909. He is also secretary, treasurer and director of the Cooper-Hewitt Electric Company; vice president and director of the Westinghouse Lamp Company; director of the Bryant Electric Company, Perkins Electric Switch Manufacturing Company, Lackawanna & Wyoming Valley Railroad Company, the Canadian Westinghouse Company, Limited, and R. D. Nuttall Company.

He is a member of the Mayflower Society, the West End Association, the American Institute of Electrical Engineers, the New York Bar Association and of the University, City Lunch, Sleepy Hollow and Thousand Islands Yacht Clubs. Mr. Terry has a delightful summer home at the Thousand Islands, New York, where he devotes his recreation time to motor boating and fishing.



Charles A. Terry,
Vice-President of the Westinghouse Electric & Manufacturing Company.

St. Paul Jovians Hold Big Picnic.

The St. Paul Jovians will hold a picnic on Saturday, July 25, at Spring Park, on Lake Minnetonka. A special train over the Great Northern has been chartered which will leave St. Paul, Union Depot, at 9:30 a. m., and leave from Spring Park at 8:00 p. m. The entertainment committee promises an unusual program for the day. There will be novelty races, a baseball game, boating, swimming, miscellaneous athletic contests and dancing. Round trip tickets will be sold to adults for $1.00 and children 50 cents. Tickets will be on sale at all the electrical houses in St. Paul. It is intended to close up the town electrically on July 25, and all the employees of the jobbing and supply houses, the contractors, the telephone and telegraph company and the central station company, with their families, will make a day of it.

Bemis To Appraise Detroit Railways.

Edward W. Bemis, of Chicago, will appraise the properties of Detroit United Railways for the purpose of giving the city a basis on which to take over the street railway lines. The appraisement will be started at once and must be completed by October 10 and the report filed by November 15.

Municipal Plant Supplies Current to Outside Coal Mines.

An ordinance has been passed at Osage City, Kans., fixing a flat rate of three cents per kilowatt-hour for all current provided from the municipal plant to coal mines outside the corporate limits of the city. This rate will apply only to operators who sign an agreement providing for a monthly minimum charge of $83.33 for each mining machine for which current is provided.

Mutual Insurance In New York.

The gas and electric companies of New York State have organized a mutual liability insurance company under the compulsory Workingmen's Compensation Law passed at the last session of the Legislature. The company, which has been named the Utilities Mutual Insurance Company, commenced business on July 1 with 69 policies written, covering about 3,000 employees.

While the organization of the company is a direct result of the enactment of the Workingmen's Compensation Law, it was possible largely on account of the past work of the Empire State Gas and Electric Association, which has resulted in very friendly relations between the various companies and in a strong sentiment for unity of action and co-operative effort.

The New York law requires insurance of employees against injuries but provides four ways in which the matter may be cared for. First, there is the state fund and the rates for insurance in this fund have been set about eight per cent less than the rates which may be charged by stock or mutual companies. Next, there are the stock companies. Third, there are the mutual companies. The minimum rates which may be charged by stock and mutual companies are now fixed by the state. Fourth, there is self insurance under certain restrictions prescribed by the state.

Each of the four methods has its advantages and its disadvantages and there was very full and free discussion pro and con among the companies before it was finally decided that as matters stood in New York State at least, the plan of a mutual company held out the prospects of greatest benefits. The reasons which led to this condition are interesting and instructive.

After all is said and done the real object to be attained both from a humanitarian and financial standpoint is the reduction in the number of accidents. With this object in mind it appeared that the mutual plan would be the most effective, as well as the most economical. It would be a matter of dollars and cents to each member of a mutual company, not only to reduce his own accidents but also to see that the other members use due care in order to reduce theirs. The standards for construction and operation which will have to be established can best be prepared by men who, through long experience, are familiar with the conditions and who know the practical end of the business. In the acceptance or rejection of risks the judgment of a board of directors composed of the executives of public-service companies who have a personal acquaintance with the applicant's conditions should be of very great benefit.

Another important argument was that a mutual insurance company in which the members would be bound together, along one line at least, by financial interests, would aid and strengthen the co-operative spirit in the Empire State Gas and Electric Association and tend to make its work in all lines even more effective.

Every year it is becoming more and more evident to progressive public-service men that what is beneficial to the industry generally is also beneficial in the long run to the individual company. Taking this broad view, a number of the larger companies, while able to carry their own insurance and, for some reasons, preferring to do so, decided that a mutual company of the kind which has been organized, would be for the best interests of the industry in the state, and they have therefore not only placed their insurance with this company but also have been very active in the large amount of premilinary work which has been necessary.

The company's by-laws provide for at least 13 directors, 11 of whom must be policy-holders. Each policy-holder is a member of the company and has one vote with one additional vote for every 500 employees but in no case can a member have more than 20 votes.

The state fixes the minimum rates which may be charged for each class of risk and the maximum percentage of premiums which may be devoted to operating and administrative expenses is set at 23.3 per cent. As an added precautionary measure the directors have fixed the rates at 10 per cent higher than the minimum set by the state.

A "catastrophe surplus" must be set aside at the rate of 10 per cent of the premiums until it shall amount to $100,000 and thereafter at the rate of 5 per cent until it shall in amount comply with the provisions of the law.

Profits accumulated after paying all losses and expenses and setting aside the necessary reserves are to be returned to the members in the form of dividends. It is also provided that, as a still further measure of safety, a fund to be known as the "certificate holders' surplus fund" shall be set up. The object is to provide a secondary defense against any catastrophe, thereby strengthening the policies issued to the members. At the end of each year a certificate will be given to each member setting forth his interest in the fund. While the fund belongs to the holders of the certificates the company reserves the right to draw upon it under certain very extraordinary circumstances which are clearly specified in the company's by-laws.

The company will promulgate and may modify from time to time, standards for construction and for methods of operating, with a view to reducing the number of accidents. It will circulate among its members, information in regard to accidents which occur, so that the necessary precautionary measures may be taken to prevent their repetition. It will employ a corps of inspectors to visit the plants of all members or applicants for membership. The merit rating system will be employed, which will give added incentive to the members to bring their plants and systems up to standard and to maintain a high state of efficiency in their accident-prevention work.

Of the 69 members on July 1, 45 are electric companies, 7 artificial-gas companies, 10 gas and electric companies and 7 natural-gas companies.

The officers are: president, J. T. Hutchings, Rochester; vice-president, J. C. DeLong, Syracuse; secretary and treasurer, C. H. B. Chapin, secretary of the Empire State Gas and Electric Association, New York City. The general agents are Parsons & Company and the headquarters are located at 51 Wall Street, New York City.

Spanish Electrical and General Exposition in 1917.

The International Exposition of Electrical Industries that was to have been held in Barcelona in 1915 has been postponed and will probably be opened in 1917 on broader lines and under more favorable conditions. In the same year in that city will likewise be held conjointly with the electrical fair the General Spanish Exposition.

A draft of a bill has just been introduced in the Cortes, which when enacted will recognize both expositions as distinctively official and under the patronage of the Government, which will then contribute toward the cost of construction of exposition buildings and expenses in connection therewith $1,800,000, the same amount as that already voted by the municipality of Barcelona. This sum is to be evenly divided between the years 1915, 1916 and 1917. By advancing the date of the electrical exposition in particular it is the purpose to have the undertaking in question of world-wide interest. The province of Catalonia particularly has made such strides in electrical enterprise in recent years that there is eminent justification for inviting nations and individuals to participate in an exposition which, though Spanish in conception and characteristics, will be original and vast enough to offer every promise of success.

Long-Distance Radiotelegraphy.

The signals sent out from the wireless station at Nauen, Germany, have been detected in the South Atlantic Ocean, 5,600 miles distant. Messages have been received without difficulty at distances up to 4,300 miles at night time. More than one-half of this distance was over the land areas of Europe and Africa.

Application of Electric Power in the Fertilizer Factory.

By F. M. Weller.

Because of Baltimore's pre-eminence among other cities in the output and variety of its manufactured fertilizer goods, and because of a particularly local interest and experience arising from a study of the application of central-station electric power to this industry, the purpose is here to present a survey of the principles underlying its existence, of the machinery involved in the manufacturing process, and finally of the present status of the local power situation.

Baltimore is a great center for the manufacture of fertilizer, and the great strides which have been made in applying motor drive to this process are shown by Mr. Weller, who is connected with the Consolidated Gas, Electric Light and Power Company of Baltimore. The article is in two parts and will be concluded next week.

Fig. 1.—Two Herreshoff Furnaces, with Ore Elevator Between, Driven Each by Five-Horsepower Motor.

The raison d'etre of the large number of these factories, from the small mixing plant of wooden construction to the more modern, extensive and costly buildings of steel and concrete, is best found by learning the secrets which nature has confided in Mother Earth to the end that the best possible fruitage may come of the partnership formed by these two. The object of the combination is ostensibly to effect a desired plant yield per acre of soil and the extent of the business, which in former years was comparatively small, has of late increased with enormous strides, following the rapid development of agriculture and the consequent drain upon the soil, due to the depletion of the elements essential for plant life. Under cultivation a succession of crops deprives the land of the constituents which are essential to healthy and luxuriant plant growth, and without an adequate return to the land of the matters removed in the produce, its fertility cannot be maintained for many years.

As for the constituents themselves which are necessary to plant life and growth, the articles of incorporation of the above concern gives them as: Carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus, among the organic matters; and potassium, calcium, magnesium, iron, phosphorus and sulphur among the inorganic or mineral matters. Each has its principal function to perform as follows. Nitrogen is chiefly concerned in the production of a strong and vigorous growth; potassium and phosphorus are essential to the production of grain or fruit; sulphur acids form the vegetable albu-

men; iron affects the development of the green color in the leaves; magnesium and lime aid in the translocation of plant food nutrients from the stem and leaves to the seed; chlorine is concerned in the movement of starch from place to place as the plant economy may require.

There are two great store-houses, or sources of supply of these elements: (1) the soil, and (2) the atmosphere. The soil contains altogether 70 elements, only 14 of which are important to the farmer, and only 10 of which have any intimate relation to the growth of crops. Of these 10, four are obtained from the atmosphere, namely oxygen, hydrogen, carbon and nitrogen, the two former being supplied from rain water taken in by the plant roots, the third being absorbed from the atmosphere as carbonic acid gas through the leaves of the plant, and the fourth being translated to the soil through the use of leguminous plants, such as clover, peanuts, cowpeas, etc., by the action of certain bacteria living on the roots of these crops, which have the power of assimilating atmospheric nitrogen. Due to the evident difficulties of this method, however, nitrogen is generally supplied by fertilizers. The soils generally contain iron, magnesium, sulphur, chlorine and lime; accordingly the elements to be supplied artificially are nitrogen, phosphorus, potassium and possibly calcium.

These were in the earliest days (1800-1850), found in guano (Peruvian chiefly), bones, etc. Today their sources and uses are as follows:

Nitrogen.—Nitrogen is a gas and therefore in this form cannot be used in fertilizers. It is always combined with other elements and may be present in one or more different forms:

(*a*) in the form of nitrates, as nitrate of soda, from the rainless regions of Chili and Peru;

(*b*) in the form of nitrate of lime, produced by the compounding of limestone and nitric acid, the latter having been prepared by passing a current of air through a chamber in which powerful electric discharges are taking place;

(*c*) in the form of cyanamid, produced by the passage of a current of air over very hot calcium carbide (made from coal and limestone);

(*d*) in the form of ammonia compounds, as sulphate of ammonia, a refuse product of coal-gas manufacture;

(*e*) in the form of organic matter (animal), as dried blood, dried fish scrap, meat scraps or tankage;

(*f*) as nitrogenous guanos, the dried excrement and dead bodies of sea fowls and bats;

(*g*) in the form of organic matter (vegetable), as cottonseed, meal, castor pomace, dried peat, etc.

Phosphoric Acid.—Phosphoric acid is a compound containing phosphorus and oxygen, and in fertilizers is always found combined with water and with varying percentages of lime. It is derived from:

(*a*) mineral sources—phosphate rock.

(*b*) animal sources—bone ash (residue from burning bones), boneblack (a by-product of sugar refining).

Potash.—Potash always means the compound containing potassium and oxygen, known chemically as potassium oxide. Fertilizers generally contain potash in such forms as sulphate of potash, muriate of potash, or carbonate of potash. These are derived thus:

(*a*) muriate and sulphate of potash are obtained from the Strassfurt (Germany) mines;

(*b*) carbonate of potash is obtained from wood ashes;

(*c*) potash in organic matter (vegetable) is obtained from tobacco stems, castor pumace and from cottonseed meal.

Formulas of all the various grades of fertilizers sold are stated in terms of the percentages of each of these three elements contained therein, and properly scientific farming involves an intimate knowledge of the soil in order that it may be supplied with the particular element or elements which any portion of it lacks. For instance, a ton of 4-8-2 goods means that the fertilizer contains 4 per cent, or 80 pounds, of nitrogen; 8 per cent. or 160 pounds, of phosphoric acid; and 2 per cent, or 40 pounds, of potash, the remaining 1720 pounds being composed of what is known as "filler." The "filler" may in various cases be water, fat, lime, cartilage, soda, magnesium, oxygen, sand, cinders, etc., any one or several of which is necessarily present because nature chemically combines them with the substance which is desired for the crops.

In the earlier days and to a slight extent at the present time recourse was had to "home mixing" to effect the proper percentages of the ingredients, but the hard and lumpy raw materials could not be reduced to fineness without the aid of appropriate machinery. The farmer has discovered that hand labor cannot compare with the machine, and that it is cheaper to pay for having the goods mixed properly by power than to work hours in the effort to do what could better be accomplished in a few minutes by a machine, especially as no amount of hand labor will properly reduce hard raw materials to a suitable degree of fineness.

Thus arose the necessity for the introduction of proper machinery, the gradual evolution of which paralleled the growth of the superphosphate industry, the latter being the issue of Liebig's theory. He in 1840 recommended returning to the soil not only the nitrogen removed by the crops, but also the mineral matter, more essentially phosphoric acid. From this time the "artificial manure" trade took its rise and ever since then the whole globe has been exploited for the purpose of obtaining the raw phosphatic materials which form the base of artificial manures.

These raw mineral phosphatic materials are obtained in the form of small rocks and pebbles, chiefly from Florida, Tennessee, South Carolina, the Arkansas-Kentucky and the Utah-Wyoming-Montana phosphate beds, the consumption in 1911 amounting to 2,494,572 long tons. This rock contains from 60 to 80 per cent tricalcic phosphate, the 75 per cent grade being usually shipped abroad and the lower-percentage grades being consumed domestically.

The manufacture of superphosphate, which signifies the conversion of the tricalcic phosphate of bones and these mineral phosphates, being insoluble in water and not assimilable by plants, into monocalcic or acid phosphate, soluble in water and assimilable by plants, forms the initial as well as the chief operation in the manufacture of fertilizer goods, as we have then the necessary phosphoric acid which, mixed with the purchased bulk of nitrogen and potash compounds, gives the final product with the desired percentages of the separate constituents.

Coming now to the manufacturing process and a consideration of the machinery employed in the modern factory, it is an open secret that with the supply of the ever increasing demand, the attendant conditions of severe competition and close margin of profit can best be coped with by the aid of electric power for the individual or grouped machines, as this invariably effects economies in the operation which would otherwise we impossible of attainment. Accordingly, we shall here deal only with motor drive and refer particularly to the high efficiency rendered available by its adoption. Further, regarding the class of power used, only the three-phase, alternating current will be considered. There are quite a number of plants now operating satisfactorily with direct-current motors; yet the majority of these systems were installed prior to the demonstrated superiority of the alternating-current motor for rugged work of this nature, and, from viewpoint of the central station, it is nearly always the case that these factories are at such distances from the point of generation as to make the transmission problem exclusively one of alternating current.

The ideal factory location is, of course, by the water's edge at a point convenient for shipping, since such a

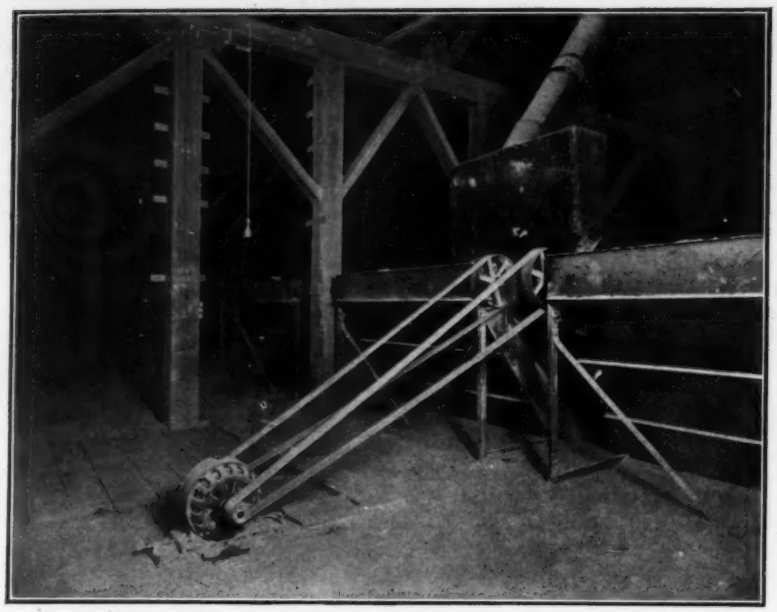


Fig. 2.—Battery of Six Newaygo Separators, Driven in Pairs by Three-Horsepower Motors.

large portion of the raw materials is imported, and so much of the finished product is exported, by water. The rock for the local trade is almost invariably delivered in this way from schooners, and electric power here presents one of its greatest advantages in its application to the unloading hoist. These hoists are of necessity located either at the extreme end of the building or on long piers where it is out of the question to extend shafting from a central steam-engine drive; and where a steam line leading to a local steam-driven hoist would prove very uneconomical at all seasons of the year, and could only with extreme difficulty, attended with prohibitive losses, be operated during winter periods, due to condensation and freezing in the pipes and cylinders. These hoists, with one to two-ton grab-buckets, have a capacity of from 30 to 60 tons per hour and are driven by wound-rotor motors varying from 30 to 60 horsepower, based on an intermittent 30-minute rating.

The rock having been dumped into a large hopper of 15 or 20 tons capacity, is then removed either by one or two-ton electric dump cars with self-contained 5 to 10-horsepower motors, by a train of several dump cars propelled by an electric locomotive with 15 to 30-horsepower motor, or in some cases by grab-buckets, operated electrically on a monorail system. The material is generally carried to the opposite end of the building and dropped near the grinding mills, or crushers, from whence the process gradually works back towards the wharf or shiping end of the building.

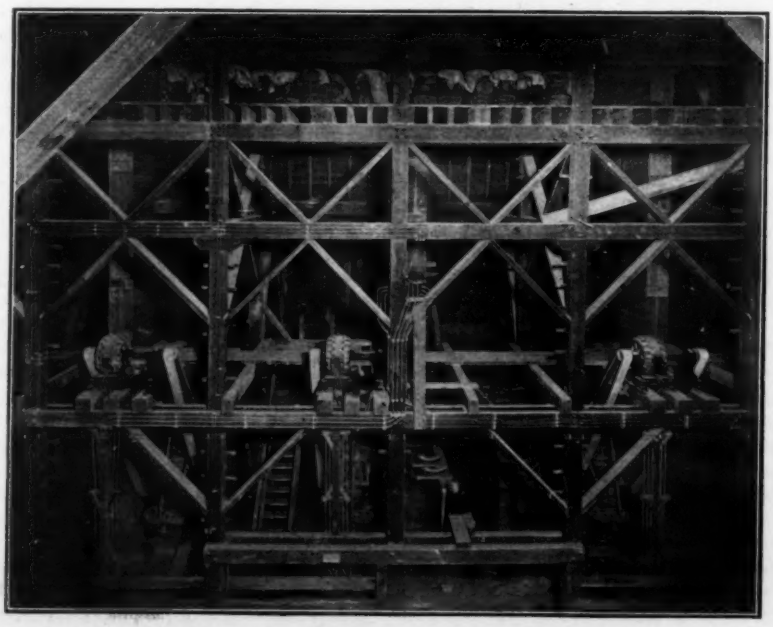


Fig. 3.—An Installation of Kent Mills with Individual 40-Horsepower Motor Double-Pulley Drive. A Three-Horsepower Motor on Belt Conveyor is Also Shown.

These motor-driven cars may be called the last word in the efficient operation of any factory. Their adoption was a real step in advance, for, independently of their very marked economy over hand labor, their ingenious applications and various uses permit the use of mechanical equipment in all parts of the factory where it would be impossible to erect shafting. They form a sort of connecting link between the different applications in the factory and contribute greatly to its increased output. Comparisons show that one such car with a single operator can do the work of from three to ten men using the old style of push car, and in some cases the pier hoist and tracking are so arranged that simultaneous loading and unloading is done, the cars then running fully loaded in each direction. Their value is further demonstrated by the fact that even in the factories now operating with steam engine and shaft drive, a small engine-driven generating set will almost invariably be found, to supply the power for motor-driven cars.

In the adoption of the most satisfactory drive for cars where three-phase, alternating current is supplied, there is a deal of difference of opinion as to the relative merits and demerits of three-phase, single-phase and direct-current motors. The first two cases involve some difficulties and complications in the trolley switching arrangement and in the proper adaptations of the motors and their control, while direct current on the other hand must be obtained from a motor-generator set which not only increases the initial investment, but is also less efficient and is liable to be overlooked and allowed to run for several hours after the demand for the cars has ceased, thus entailing unnecessary consumption of power. This latter trouble, however, may be obviated in part by push-button control stations located along the car tracks, within easy reach of the car operators. Local factories contain examples of both the three-phase, alternating current and the direct-current systems, and apparently the operators of each are equally satisfied.

The next step in the process following the depositing of the rock near the grinding mills is to transfer it to the

mills themselves. Through the agency of belt conveyors operating in concrete trenches which extend back under the piles of rock in several directions, the material is taken from any portion of same and dumped into the bucket-elevator pits, being then carried up two or three floors to a large rock hopper, from whence it falls by gravity through chutes to the grinding mills, on the ground floor. The belt conveyors, usually 14 inches wide, operate at a speed of 250 to 300 feet per minute, carry from 60 to 100 tons of phosphate rock, 1.5-inch size and under, weighing 100 pounds per cubic foot; per hour, and require from 3 to 5-horsepower motors each. The motors drive to countershaft with 20-inch pulley which operates at 190 revolutions per minute. These motors are located in sight of the mill operator and their control near that of the mill motors, as the two are interdependent to a certain extent and a stoppage of the belt conveyor without interrupting its gravity feed from the rock piles would result in a very troublesome choke. The bucket elevators have a duty of from 30 to 60 tons per hour, and at an operating speed of 200 to 250 feet per minute, require 5 to 10 horsepower. The motors generally belt to a countershaft with 42-inch pulley operating at 106 revolutions per minute.

Of the grinding mills more usually employed there are several makes, a general comparison of the most popular showing distinguishing characteristics as outlined below. Their ratings are based upon the quantity of the ground material which will pass through a certain mesh screen, generally 96 per cent through 60 mesh, and as a rule are higher than obtained in actual practice, owing to the fact that the grinding rolls wear in time and the efficiency of the mill is thereby greatly reduced. There is very little reduction in the power required to operate, and superintendents of factories have more than once wondered at the increased ratio of power costs to tonnage ground with reduced output, until the riddle was solved by the insertion of new rolls. There are, generally speaking, two classes of mills, the one having self-contained screens and the other operating in conjunction with detached screens located on an upper floor. The actual results of any unit in practice vary from three to six tons of the requisite fineness of dust per hour.

The Kent, or Maxecon mill, has a central concave movable steel roller, against the inner surface of which press three convex rollers spaced equidistantly around the periphery, one being attached to the driven shaft and the pressure of all three as they rotate being regulated at will by spring tension. The rock, fed in at the side, is subjected to the pressure of the three rollers at each revolution of the outer roll, discharges from the lower side of the mill to the elevator pit and joins the fresh rock in its upward passage, via the bucket elevators. From the elevators the mixture falls to the screens where the coarse is separated from the fine, the former returning to the rock bin and the latter to the dust bin, to await the mixing process. Fig. 2 shows a line of six of these Newaygo or Perfection separators, driven in pairs by three-horsepower motors. In Fig. 3 is shown the companion group of Maxecon mills, each driven by a 40-horsepower motor with the double-pulley drive. The power required for a Maxecon mill operating at 200 revolutions per minute may vary from 30 to 50 horsepower, due to the width of feed-gate opening, the variable percentage of mixture in the raw material, fineness and quality of the rock, the tension of the rolls, their condition, etc. From personal experience, we would recommend the use of a 40-horsepower motor and the double rather than the single-pulley drive, as tests have shown a greatly improved steadiness of operation and a saving of approximately 15 per cent in the power required to operate, as follows:

Five-inch feed with normal roll tension. Heavy feed. Single-pulley drive (36 by 12-inch pulley): maximum motor input, 50.9 horsepower; average motor input, 48.7 horsepower. Double-pulley drive (each pulley 36 by 8 inches): maximum motor input, 46.47 horsepower; average motor input, 40.26 horsepower.

Five-inch feed with roll tension increased by one turn of pressure bolts. Single pulley: maximum motor input, 51.9 horsepower; average motor input, 50.9 horsepower. Double pulley: maximum motor input, 48.6 horsepower; average motor input, 44.4 horsepower.

The mills were here producing about 4 tons of 90-per-cent, 60-mesh dust per hour.

The Sturtevant mill, like the Maxecon, employs a group of horizontal rollers, and uses the detached screen. Its general operation is much the same, but the output is slightly higher, and the power required per unit of output is slightly lower than the double drive and considerably higher than the single-drive Maxecon. The ring itself, which is the driven member in this case, operates at 60 to 75 revolutions per minute and one gear reduction is furnished so that the countershaft carrying the driving pulley has a speed of 300 revolutions per minute. There are five sizes of this mill, varying from a 24 by 7-inch ring requiring 8 to 12 horsepower, to the duplex 44 by 12-inch ring mill requiring 70 to 90 horsepower. Tests taken on the No. 2 Ring Roll Sturtevant, which is the most popular size for this work, show an average motor input of 75 horsepower, when producing 7.7 tons per hour of 88-per-cent, 60-mesh dust.

The Pratt mill is of the self-contained screen type, and differs further from the two preceding in its employment of vertical rollers which come into operation through centrifugal action, the fine passing upward to dust hopper by bucket elevator and the coarse being thrown up by scoops to be ground further. Test results at an output of 5.37 tons of 92-per-cent, 60-mesh dust per hour, give a motor input of 81 horsepower.

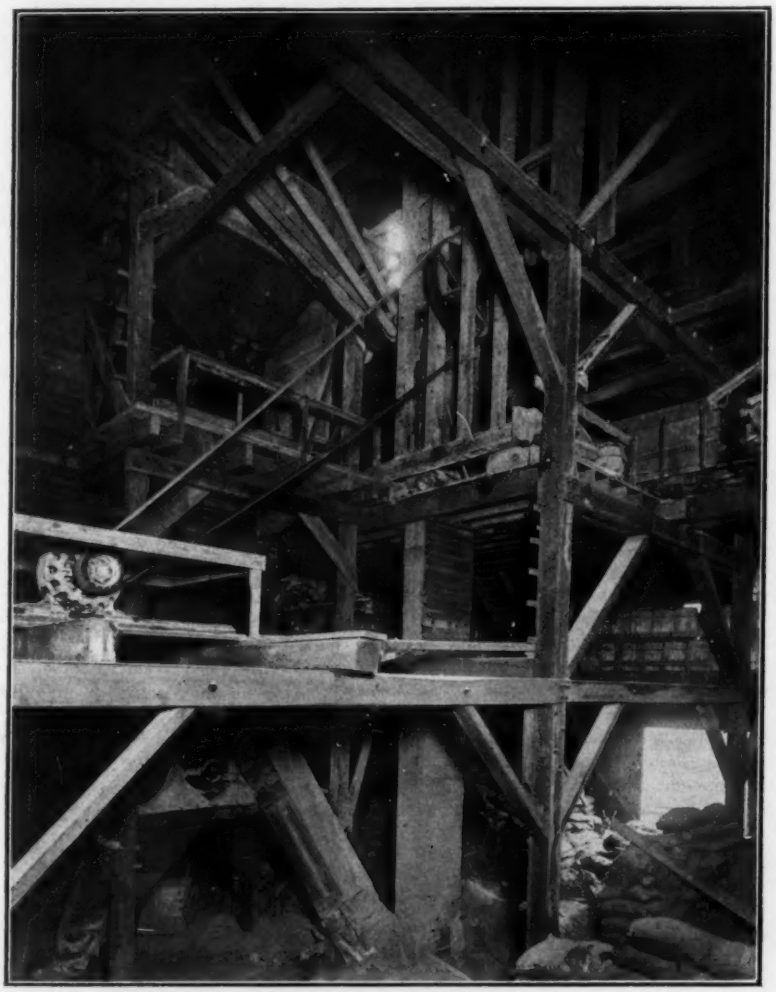
The Griffin, or Bradley three-roll mill is of the same general type as the Pratt, and while no personal tests have been made, the usual practice is to drive with a 40 or 50-horsepower vertical motor. This is a vertical-shaft machine depending on centrifugal force for the pressure necessary to reduce the material. The use of vertical belted motors has become so general for driving the Griffin mills that special machines have been developed for this service. These are two-bearing motors, the upper bearing forming a combination guide and thrust. The thrust bearing, which carries the weight of the rotor, shaft, etc., is a roller bearing in all cases. The upper guide is generally a ball bearing and the lower a babbitt guide bearing. Oil for the bearings flows from the upper to the lower and is pumped back to the upper reservoir when the shaft rotates.

Rather the latest development in this line is the Raymond Pulverizing Air-Separating System, whereby the fine dust is separated from the coarser rock by vertical suction. This system comprises a vertical four-roller mill requiring about 70 horsepower, and a suction fan with about 30 horsepower. The rolls are suspended from a crown plate and work radially by centrifugal force against a steel ring or die. The driving shaft is horizontal and works through bevel gear and pinion to the rolls. This shaft operates at 215 revolutions per minute and has a 48 by 10-inch pulley. The fan, with 14 by 10-inch pulley and operating at 1,100 to 1,400 revolutions per minute, draws the fines into a dust collector, where it is caught and discharged through a spout to a conveyor, while the heavier particles fall back into the mill. Its claim for superiority lies in the more uniform grinding, and in the ability to produce superior goods having the smallest amount of insoluble matter, besides effecting a saving of 10 per cent in the amount of acid necessary for proper mixing.

In making any comparison as to the power required to operate these various systems it should be borne in mind that there must be added to the requirements for the external-screen type, the power needed for the screen (generally about 1 to 2 horsepower) and for an additional bucket elevator (generally 5 to 10 horsepower). Further, the only proper basis for comparison is, of course, the horsepower consumed per ton output.

The dust now being stored, the next process consists of mixing with sulphuric acid. The production of this acid is a very important branch of the fertilizer industry, since almost the same amount of 50-degree-Baumè acid is used as phosphate rock consumed. Its cost must be kept as low as possible, and to this end some manufacturers prefer to install their own plant for its production. In this case there must be available space almost equivalent to that occupied by the factory, and plenty of capital to warrant the large investment required for the special equipment. In turning aside from the main process for a few moments to investigate such an installation, the typical equipment of a 60-ton-per-24-hour capacity plant will be outlined.

The raw material in the form of pyrites is imported chiefly from Sicily and from Spain. In the initial stage of the process the ore is burned in two large revolving furnaces, generally either the Wedge or the Herreshof type, being fed in at the top and gradually directed downwards, burning all the while, by revolving raker arms, until the residue is removed from an opening in the bottom of the furnace. These raker arms, which are kept cool by the circulation of either water or air, are propelled by five-horsepower motors, which are shown in Fig. 1, as well as the ore elevator, with five-horsepower motor, which brings the ore twice an hour up to the tops of the furnaces. In its passage through these the pyrites is oxidized, the sulphur being converted into sulphur dioxide, and the iron into iron oxide due to the presence of atmospheric oxygen. The gases leaving the furnaces contain approximately 8.5 per cent of sulphur dioxide and register about 1,000 degrees Fahrenheit. Whereever much dust is present it is deposited in a dust collector. The sulphur dioxide on leaving the dust chamber passes through the niter oven, where it comes in contact with the oxides of nitrogen, if nitrate of soda has been charged, and then passes on through a Glover tower to the acid chambers. In the Glover tower the hot gases denitrate the nitrous acid received from the Gay-Lussac tower, weak nitrous acid from the last chamber being used to dilute the strong nitrous acid. The chamber process is as follows: The sulphur dioxide, oxygen and water combine with the aid of nitrogen trioxide, the nitrogen trioxide being again liberated to continue its action.



35-Horsepower Motor Drive on Bagging Machine, with Rotary Mixer, Screens, Disintegrator and Bucket Elevator. A Motor-Operated Car is on the Track Alongside the Bagging Machine.

The water for this reaction is supplied by a 10-horsepower motor-driven triplex pump, with a 15-horsepower motor-driven centrifugal pump held in reserve, and is admitted through platinum spray nozzles installed in the tops of the chambers. The transference of the gases through the chambers is effected by a five-horsepower motor-driven fan, while a 25-horsepower motor-driven compressor completes the list of machinery. The air from this latter is passed from a storage tank into a lead reservoir known as an "egg," which forces the acid from storage tanks under the chambers, to those in the acidulating department. This indirect method of pumping is rendered necessary by the inability so far to find any metal which in pump form could withstand the corrosive effect of the acid for any considerable length of time.

In such a plant every precaution must be taken to guard against any interruptions to the process, as these would mean severe injury to the product, and loss of production.

As preventive measures there are installed, besides the reserve hydraulic pump mentioned above, an outside storage tank for water and a reserve air compressor.

Having now the dust and the acid stored near the acidulating department, the next step is to bring them together. This very important part of the process is attended with a great deal of care, for the superiority or the inferiority of the bagged goods depends largely on the quality of the acid phosphate resulting from this mixing. The mixers are usually cast-iron revolving pans, with double revolving

plows running in opposite directions, and the discharge is from the bottom into the acid-phosphate "hot dens." The size employed varies from 0.5 to 2 tons capacity, the one-ton mixer proving more popular, as it simplifies bookkeeping by functioning so as to produce a net ton at each mixing. With this size from three to five-horsepower motors are used.

Approximately equal weights of dust and acid are employed, the dust-hopper gate being opened first, the dust accurately weighed, and then discharged into the mixer, to be followed by the measured amount of acid. The action which now takes place consists of the decomposition of the tricalcic phosphase by the sulphuric acid into monocalcic phosphate, or acid phosphate, and gypsum, according to this formula:

$$Ca_3(PO_4)_2+2H_2SO_4+5H_2O=$$
$$CaH_4(PO_4)2H_2O+2CaSO_42H_2O$$

Or tribasic phosphate of lime=monocalcic phosphate+sulphate of lime.

From the mixture a very high temperature results, which rises still higher in the closed "hot dens" into which the material now falls to remain properly for about 12 hours. These dens are brick-lined to withstand the heat and corrosive action of the acids and are connected at the tops with a flue through which the carbonic acid gas and the chlorine and fluorine compound vapors are extracted by a motor-driven ventilating fan generally requiring from 5 to 10 horsepower. These flues are also arranged to remove the gases directly from the mixing pans in operation, and by the extraction of the gases the health of the workman is safeguarded and a drier and more valuable superphosphate is obtained. In connection with these exhaust fans it is frequently desirable or necessary to condense these gases by expelling them to a tower containing water sprays.

A more compact and somewhat more efficient system is that of the Koerting Vaporizer, which combines the water spray and gas flue in one, causing the absorption of the gases in the water and using for its operation only a small motor-driven hydraulic pump. Doors are properly provided at both ends of the dens and a discharge opening down the center of each den floor.

We next find a group of three to five-horsepower motors driving horizontal plate or apron conveyors 24 inches wide, which run under these discharge openings for their entire length and remove the dried acid phosphate, as dug out by pick axes, to the acid-phosphate elevator pit. This bucket elevator, with a capacity of 60 tons an hour and driven by 7.5 to 10-horse power motor, delivers into a hopper, and thence to dump cars which may either be operated by cable from the same motor as the elevator, or may utilize the motor-driven cars directly. These bucket elevators operate at 230 feet per minute through a countershaft running at 160 revolutions per minute. The plate conveyors referred to above are generally driven through the medium of a countershaft operating at 60 revolutions per minute, and the more usual capacity is 20 tons of acid phosphate per hour to a conveyor speed of 70 feet per minute.

A decidedly modern device, made by the C. W. Hunt Company, is now being applied here with good results. The apparatus consists of the regular car which operates in series with a cable and an adjustable weight, the latter counterbalancing in such manner as to bring the car back up its slightly inclined track as soon as the tripper which is set at the unloading point has effected the dumping of the load. No power is required to operate this system, and therefore its economies are manifest.

This basic acid phosphate, being thus delivered to any part of the factory, is then ready for direct sale or for mixing with other ingredients to form one of the various brands of fertilizer goods, each with the specified percentages of ammonia, phosphoric acid and potash.

For this latter operation the machines now brought into play are what are known as the bagging or mixing machines, Fig. 4, consisting each of a system of bucket elevators, a disintegrator or clod breaker, either a rotary or an inclined shaking screen and very often a rotary mixer to insure the various materials being thoroughly mixed. The materials are brought in barrows from their separate bins, carefully weighed and delivered to the elevator pit, one ton at a time The function of the machines is to completely powder and combine and deliver the finished product, ready for shipping, into bags or barrels as the case may be. Their usual rated capacity varies from 15 to 25 tons output per hour and from 20 to 35-horsepower motors are employed.

As if the smallest were retained for the last, mention should be made of a bag-printing machine equipped with one-horsepower motor, the use of which by the manufacturers of today is well nigh universal. This should be located some distance away from the main building on account of insurance.

(To be continued.)

Early Books on Electricity.

The Carnegie Library, of Pittsburgh, Pa., recently had the good fortune to secure a collection of early technical books, more than 100 volumes of which pertain to electricity and its applications. This library is especially strong in the recent literature of electrical engineering, as an effort is made to acquire all important books as soon as published, and more than 30 electrical periodicals are received and bound, and the contents card-indexed.

A New Emblem Proposed for the Electrical Profession.

Robert Montgomery, manager of the commercial department of the Louisville Gas & Electric Company, Louisville, Ky., has designed the emblem which is reproduced herewith as a distinctive symbol for the use of the entire electrical profession. His idea was to devise an emblem which shall readily proclaim at a glance that the user, whether a firm or an individual, is engaged in the electrical industry, and also at the same time indicate by the numerals shown on the button or emblem the year in which his connection with the business began. Thus in the particular emblem shown it would signify that the person or firm wearing or using it was not only connected with the electrical industry in some manner, but

Proposed Emblem.

had been continuously engaged in the business since 1896.

A number of electrical engineers have endorsed the proposition to adopt this emblem and the Kentucky branch of the National Electrical Contractors' Association has also heartily endorsed it. It is proposed to furnish the emblem at moderate cost in the form of a gold button with black enamel inlay, and the Electric Emblem Company, Louisville, Ky., has been organized to distribute the emblems to those persons or firms who on investigation have been found entitled to their use.

The Value of the Ohm.

The annual report of the National Physical Laboratory, England, tells of the completion of the research by F. E. Smith on the absolute measurement of the standard of electrical resistance. The work is believed to be more accurate than any hitherto done on the absolute measurement of resistance and the result shows that the international ohm, instead of being 10^9 C. G. S. units, is actually 1.00052 times this value. This may be otherwise expressed by saying that the column of mercury, in order to have a resistance which is an exact multiple of the absolute unit, should have a length 106.245 centimeters instead of 106.30 centimeters, as was adopted for the international ohm.

Commercial Practice
Management, Rates, New Business

THE STANDARDIZATION OF TARIFFS.[1]

By J. Horace Bowden.[2]

Before standardization of tariffs can be brought about, it is essential that the broad lines of policy to be adopted should be generally agreed upon. Unfortunately for the electrical industry, the object of primary importance in the minds of many local legislators is that an undertaking exists solely for the making of profits for the relief of taxes. Others again become imbued with the idea that the compulsory system of loans redemption means that at some future date the local authority will have acquired an asset capable of producing large revenues for the public use, and therefore, by shortening the periods of redemption, the consummation of their ideal will be realized at the earliest possible date. These measures must be eliminated from electricity policies before it is possible to bring about standardization of tariffs.

In the author's opinion the primary object of a municipal supply of electricity is the universal use of energy for power, light and heat at the lowest possible cost to the consumer, compatible with efficient service. The secondary object is the concentration of fuel combustion in a given area, and at that center the obtaining of efficient combustion.

If it is recognized in the policy of an undertaking that the supply is established for the benefit of all tax payers, there is no logical reason for restricting the progress of the supply by imposing charges higher than are necessary to cover actual expenditure. The ultimate aim is to afford the supply to every user of power, light and heat in the area, and that aim can only be accomplished by supplying at the lowest possible rates. Apart from all considerations of hygiene, the dominating factor in the use of electricity is price.

Electricity, originally supplied as a luxury, is now rapidly becoming a necessity, and it must be admitted that public necessity ought to be supplied at the lowest possible cost.

1 Portion of paper presented at convention of Incorporated Municipal Electrical Association, Birmingham, England, June 16.

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If it were possible to so arrange tariffs as to produce an income exactly equivalent to expenditure, such tariffs, if conceived on equitable bases, would undoubtedly be ideal, but there are contingencies which prevent the consummation of the ideal, notably the fluctuations in the price of coal and maintenance of plant, buildings and mains.

It is practical to create a contingency fund in order to equalize these fluctuations over a period of years, but even if such a course were adopted, the prudent manager must always provide a sufficient margin to show a surplus at the end of the period, therefore, in a successfully managed undertaking there should always be a balance available for disposal outside the working of the undertaking. This margin or surplus would, of course, vary with the output of the undertaking, and in a progressive concern the sum available should increase each year.

The immediate future holds out the prospect of large sums being necessary for laying mains and providing meters and services.

All members of the Association have probably heard from time to time that "electricity is in its infancy." This stage has expired, and we now find that electricity has reached sturdy manhood, but, as far as cooking and heating are concerned, it may still be stated that electricity is in its infancy. Recent developments in electrical cooking and heating appliances, however, tend to indicate that even this branch is passing from its infantile stage, and that in the immediate future we shall witness the passing of gas cooking and heating. No one can conceive of the enormous impetus that will be given to the electrical industry during the next few years if the management is untrammelled by false capital restrictions.

The author does not advocate the borrowing of money to supply cooking and heating appliances on hire; provision should be made out of revenue for any expenditure that may be necessary in this direction. Many customers will no doubt purchase these outright, but provision should be made to supply a definite number each year for hiring out, particularly in working-class areas.

The Tariff Ideal.

The author submits, without fear of contradiction, that any system by which a return to the undertaking could be made by each customer of the exact cost entailed by the demand of each customer, would be ideal.

Municipal trading does not admit of penalizing one consumer for the benefit of another, or one class for the benefit of another class. Such a principle is as fallacious as taxing one class of the community (consumers of energy) for the benefit of another class (the general body of taxpayers) by exacting contributions to taxes from electricity funds.

While it may be true that the laws of expediency govern private enterprise, it should never be lost sight of that municipal enterprise is governed by the laws of equity. No argument, however specious, will alter the fact that it is inequitable to supply to one class of consumer at a loss which is to be recouped from another class.

The future practice in electricity supply is undoubtedly that which will enable an authority to assess an annual charge for declared requirements, irrespective of the purpose to which power may be applied, or to the extent that such power may be used.

The present-day practice renders it essential that a secondary charge must be made in order to restrict unlimited use of power for the sole reason that certain running costs are entailed in the production of electrical energy.

There is a possibility in the near future that these running costs will be entirely eliminated by the sale of by-products resulting from the gasification of coal, and the use of the gas and coke products for steaming purposes, or for gas turbines or other gas-driven plant, and further revenue may be obtained from the sale of exhaust steam for heating, etc.

From the present day to the period when the practice forecasted may become practical, a secondary charge remains essential, and it is in the interests of all concerned in the supply to standardize such charge, and for this purpose the Association known as the "Point Fives" came into being.

The charge of 0.5 penny (or one cent) per kilowatt-hour carries with it, in modern undertakings, a sufficient margin over and above running cost

to allow for fluctuations in price of coal, and provision against all contingencies such as breakdown of electrical machinery and failure of distributing and feeder cables.

Some managers have considered it expedient to apply only the secondary charge for domestic purposes. Others again, have considered it expedient to impose the primary charge on one class of supply only, viz.: lighting, and to apply the secondary charge to all other uses. It does not require reasoning powers to foresee that a policy of this sort is of a transient nature.

The Norwich, or Rateable-Value System.

It is the author's intention to refrain from criticizing existing systems of charging as much as possible, but many managers, realizing that past methods have tended to unpopularize the use of electricity, have adopted the rateable-value system for assessing a primary charge; but no more pernicious system has ever been introduced into electric practice. Its only attributes are those of expediency and simplicity in its application to domestic property, which no doubt was the original intention of the introducer.

Apart from the insurmountable objection to this system raised by the fact that tenants in houses similarly assessed may make most divergent demands upon the resources of an undertaking, there are many serious obstacles to the attainment of permanent adoption.

Rateable value is generally dependent upon rent obtainable, and varies accordingly. Take the instance of property in a decadent area; as the value of property decreases the demand for electricity would naturally increase from the fact that, originally in the possession of one family, it degenerates into tenements of several families.

It is useless to advance the argument that the poorer tenants would not demand a supply, as the ultimate aim is to supersede all other sources of power, light and heat. In this case we have the instance of a falling revenue with an increased cost.

Again, the working class is generally more prolific than the genteel class, and, having a greater number of mouths to feed, cooking operations are carried out at more frequent and irregular hours of the day, thus raising the diversity-factor for their class.

When the case of the shop-keeping class is considered, there does not appear to be any justification whatever for the system. Shop rent is chiefly dependent upon environment, and premises in a main and important thoroughfare may command double the rent of similar premises in a street of minor importance, whereas the latter may require greater illuminating power than the former in order to attract attention.

Instances are constantly arising of changing of proprietorship, and consequent change in demand for lighting, according to the nature of the business involved, without any change whatever in the rateable value of the property.

The application of the rateable-value system to factories is perhaps more appropriate than to any other class of supply, and the rating officials would probably welcome an innovation whereby the horsepower installed would come directly under their notice, but it is doubtful if the consumer would duly appreciate a rise in rateable value consequent upon his increased demand for electric power. It appears to be a curious fact that the only equitable application of the rateable-value system would act as a deterrent to the adoption of electricity because, as a natural sequence to the installation of, say, an additional 100-horsepower motor, the Electricity Department would apply to the Rating Department to make an increased assessment on the property of that particular consumer.

The strongest advocates of this system would strenuously oppose the application to factory supply, and but few would attempt to apply it to business supply of any description.

But apart from the inherent impracticability of rateable value as the basis of fixing a charge for universal supply, there is the objection of handing over to another department the onus of fixing the primary charge for electricity.

The Use of Diversity-Factors in Assessing Fixed Charges.

The principal obstacle to standardization of tariffs is the fact that conditions of supply vary considerably in almost every area, and it has been urged that it is impossible to set forth any system that could be equally applicable to all undertakings.

But this argument can also be applied to each individual consumer, as no two consumers make exactly similar demands upon the undertaking.

It is this diversity in the use of energy that imposes upon supply authorities the necessity to adopt a form of assessment as the primary charge, and if it can be shown to be practicable to establish a tariff on an equitable basis applicable to the demands of any area, it is equally practical to standardize a system that is applicable to all areas.

The accepted definition of the diversity-factor in a supply of electrical energy is "the result of the sum of the consumers' maximum demands, divided by the combined maximum demand upon the system."

When energy was principally used for lighting purposes this factor was of considerable importance, as by its use it was practical to fix the annual assessment, and divide it into daily use of the consumers' maximum demand.

Assuming that by dividing the standing costs of an undertaking by the maximum demand upon the system the cost was found to be $80 per kilowatt, and the ascertained diversity-factor was 1.5, and the selling price of energy two cents per unit, then the charge to the consumer was $(80 \div 1.5 \times 365) + 0.02$ per unit for one hour's use of each kilowatt of maximum demand, the result being 16 cents per unit, all further use being charged at the selling price of two cents per unit.

The maximum-demand system became practically standard for lighting uses of electricity, but the great difficulty in explaining its operation to the consumer sufficed to act as a deterrent to progress, and, as a sacrifice to simplicity, departures were made by reducing the primary charge with a corresponding raising of the secondary charge, or by the institution of a flat rate based upon average use.

In this manner the inherent equity of the original system was stultified and the consumers at once became divisible into "bad" and "good" from the supplier's point of view.

As good consumers must of a necessity compensate for bad consumers in any solvent business, the cultivating of electricity supply became subject to the laws of expediency, and as progress has been made in power supply and more recently in heating and cooking and other uses of electricity, the law of equity has apparently been more and more lost sight of.

It is bad for municipal trading that this state should have been evolved. It is the law of equity that teaches that one taxpayer (or class) should not benefit at the expense of another, or that one consumer of electrical energy (or class) should not benefit at the expense of another.

There is apparently no reason why every consumer should not utilize the service to such an extent as to make a return in full, as nearly as may be, of the cost of such service, and it is to be expected at the hands of the administrators of the supply so to adjust tariffs as to conform with the laws of equity. This can best be done by studying the conditions of each class of supply in each individual area upon its own merits, and estimating the relationship of the demand for each class to the actual maximum demand upon the system.

In Poplar, which is an industrial area, the following scale has been adopted:

Nature of Demand.	Diversity Factor.
Public lighting	1.0
Business lighting, internal	1.0
Business lighting, external	1.2
Intermittent power	2
Domestic lighting, general	2
Domestic lighting, occasional	8
Cooking and heating	20

The maximum demand occurs between 4:30 and 4:40 p. m. At this particular period the whole of the public lamps are in lighting, and at first consideration a unity factor appears to be correct. But it must be taken into consideration that in some of the streets mains are laid from which little other demand than for public service is made, carrying with it capital and administrative charges; therefore a slightly higher charge has been considered admissible to cover this cost.

Business Lighting.—The charge is based on watts installed, it being assumed that a consumer does not install lighting outlets unless required, and that all internal lighting will be in use at the period of maximum demand. It is not the usual business practice to light up externally until later in the day, and by dividing the ascertained standing cost per kilowatt by 1.2 any discrepancy lies in favor of the central station.

This is an instance where the difference in conditions of load between different cities is most pronounced. In many areas external business lighting is in full demand over the peak load, and no deviation from the unity factor is permissible, but in a locality where the supply is given under similar conditions to Poplar, in order to encourage external business lighting the tariff might be adjusted by the adoption of a diversity-factor of 4 or 5 without prejudice to the interests of other consumers.

Intermittent Power.—The assessment on power supply is subject to other considerations than in the case of lighting. Every works of any importance installs a certain amount of power as standby both in regard to number and size of motors. It must be left to the discretion of the manager and his committee to make allowance for this standby. As a general rule 75 per cent of the total kilowatts installed may be taken as the normal load, but what may be termed the internal diversity should be considered in each case on its merits.

The diversity-factor of two has been taken as the relationship of the normal load to the maximum demand, as it is generally found that motors are slacking down gradually from 3 p. m., therefore at 4:30 to 4.40 p. m. not more than one-half of the connected normal power load is likely to be in use at that time.

Experience only can prove the efficacy of this assumption, but in a case like Poplar where the power load preponderates it has been fairly well proved. Out of a total sale of 16,716,705 kilowatt-hours, of which 2,665,135 units were supplied under bulk conditions, and 921,918 units for public lighting purposes, the local energy output was 11,284,056 units, whilst for lighting and other purposes within the area the supply amounted to 1,845,596 units. Therefore, of the private supply within the local area, no less than 86 per cent was for power purposes, and, notwithstanding the high price of coal prevailing during the last year, the annual surplus was practically double that of any preceding year. This increase is not totally attributable to increased business, as more efficient generating sets were brought into use during the year, but the improvement may be stated as 3 and 2 due to increased efficiency and increased business respectively, which sufficiently proves the efficacy of the tariff bases.

It has not come within the province of the Poplar undertaking to deal with any 100-per-cent load-factor supply, but the author has no hesitation in stating that any tariff based on a greater diversity-factor than unity, would not produce results equivalent to those obtained from an intermittent supply on the bases quoted. Such a load is eminently attractive to the supply manager, and very often great concessions are granted in order to obtain the load, but these concessions do not bear justification, and should receive very great consideration before being granted.

Domestic Lighting.—A distinction has been drawn between general and occasional lighting. The demand has been assessed upon watts installed, and occasional lighting is generally understood to include bedrooms, cellars, offices and upper landings. In fixing the diversity-factor at two for general lighting regard was had to the fact that under ordinary circumstances the whole supply would not be in use at 4:30 p. m., and at that time a certain allowance must be made for visiting and shopping. In purely residential areas it would perhaps be unwise to allow for this margin of diversity, but in the Poplar area the figure is capable of expansion, and when revising tariffs a wider diversity will no doubt be allowed.

For occasional lighting the factor of eight is not unreasonable, and certainly admits of many additional outlets being installed which otherwise would be left out.

Cooking and Heating.—Perhaps the most difficult problem to consider in tariff framing is an equitable charge for the demand for cooking and heating.

It is obviously unfair to make the assessment on watts installed. The cooking outfit in one residence may be on a liberal scale, and include heating elements that are not called into requisition for everyday use, whilst in another where first cost is of greater importance, daily use may be given to all the elements comprising the outfit. The type of cooker also has some bearing upon the assessment; a rapid heater, although involving a greater demand, is used for shorter periods, and, therefore, the diversity is increased.

The demand for heating also largely depends upon the liberality of the installation. A consumer who can afford to install radiators in each room where required allows for a greater diversity in use than one who only installs one radiator, to do service for the whole residence. However, there should be no difficulty in framing a scale to allow for these varying conditions.

In assuming a diversity-factor of 20, three peak times had to be considered. The daily power peaks occur at 11 a. m. and 3 p. m., as nearly as may be, and, by the lighting peak converging upon the power load, which produces the maximum demand, a third peak is created in early winter at 4:30 p. m. or thereabouts. The load at 12 midday is reduced to some extent during dinner time, but the bulk of the drop is at 1 p. m., which lasts until 2 p. m. It can be reasonably assumed that cooking operations will not commence until after 11 a. m., nor be continued after 2 p. m., therefore the probability of a heavy increase in the day peak is remote, but the acquisition of a load to fill the gap between 11 a. m. and 3 p. m. is most important. It may, however, be assumed that the demand will be felt at 4:30 p. m. when preparing afternoon tea and the workers' evening meal, but the loading required for the preparation of these meals is considerably less than for the midday meal, and the circumstances already alluded to of visiting and shopping in the afternoon must naturally affect the demand.

Taking everything into consideration, it is not unreasonable to assume that less than one-twentieth of the capacity of cookers installed will be in use at 4:30 p. m. on that particular day when the maximum demand occurs.

In dealing with this question, it has also to be borne in mind that the cooking load will almost invariably, in an industrial area, be largely supplied through mains practically unaffected by the demand for power, therefore the additional load imposed upon the system will involve capital expenditure principally on plant and buildings.

The demands for cooking and heating appear to hold out possibilities perhaps as great as that for power. It needs no great prophetic spirit to forecast large supplies of this nature in the immediate future, due to the immense strides made in the production of heating appliances during the past year, and the promise of still further improvements shortly. Supply managers should now be prepared to meet these prospective demands, and for organized competition with gas.

That cost of supply is the dominating factor must not be lost sight of. It is certainly an asset to be able to point to

other advantages accruing from the use of electricity for cooking purposes, but the most important point is that the cost of supply should not exceed that of a similar service with gas.

The author submits that the price of electricity when in general use for lighting and cooking should not exceed 1.5 cents per unit, competing with gas at 60 cents per 1,000 cubic feet, or thereabouts. In fact, in order to beat gas competition out of the field, this price should permit of the inclusion of hire of cooker, heaters and wiring installation, in order to encourage that liberality of use necessary to ensure the supply being profitable.

Conclusions.

Diversity has been exhaustively dealt with in the main contention of the paper, but a final word upon the value of load-factor is necessary.

The principal feature of the system outlined is that each consumer obtains the benefit of his own load-factor, or in other words, the "good" consumer does not make up for the "bad" consumer. Hitherto the ideal load obtainable has been that of 100 per cent, the maximum demand of an individual extended over the whole 8,760 hours of the year.

The cooking load offers totally different possibilities. An individual load-factor of 10 per cent is quite usual, but where the diversity is 20 the value of the class is double that of the 100-per-cent individual load-factor consumer. Probably this statement will sufficiently explain the reason for low rates for domestic supply.

The paper would not be complete without reference to what might appear to be an important omission in connection with charges for a universal supply of electricity, viz., the prepayment system.

The author has purposely refrained from introducing this phase of the supply because of the fact that little data are as yet available. It is proposed to go well ahead in Poplar very shortly, but the scheme is not well enough advanced to place before the members.

Roughly, the outline of the policy is as follows. Mains will be laid in every thoroughfare at the earliest opportunity, thus entirely eliminating gas from the streets.

In connecting up the first objective will be tenement buildings, which present the least initial outlay per head of the population.

The service will comprise wiring for lighting, and include, where desired, hotplate, cooker or radiators.

The consumers will be divided into three classes: lighting only, lighting and hotplate, and lighting and cooker. Payment will be obtained through penny coin meters at a rate according to the demand of each class.

The cooking class will probably be charged at the inclusive rate of 2 cents per unit (lower if possible), but an average monthly use of a given number of units must be registered or the meter will be changed to the hotplate class at, say, 4 cents per unit, also with a minimum monthly use from which transfers would be made to the lighting class at, say, 8 cents per unit, beyond which, being the maximum rate for lighting, it is impossible to go.

As stated, this is a rough outline; which may be improved upon as experience is gained, but recent developments in cooking and heating appliances warrant steps being taken to cater for the requirements of the poorest classes of the community.

At first sight these proposals savor somewhat of a departure from the equitable law which is upheld to government charges for supply. The circumstances are different to any other supply, and demand special consideration.

In anticipation of the demand, the author has had for some time past various types of prepayment meters for testing purposes. Originally he favored the idea of, and has had specially made, a differential meter which would change over after the insertion of a given number of pence at a higher rate than one cent per unit, which would, with a certain monthly use at a high rate, return to the undertaking the fixed charge based on the cost of the installation, and then allow of the continued use to the end of the month at the running charge only. The great objection to such a system is that at the end of a month a consumer would probably be obtaining energy at the rate of one cent per unit, but on the first and following days of the following month would have to pay 8 or 4 cents as the case might be. It was recognized that any such system would find ill favor with the working classes as it would be impossible to explain the ethics governing such procedure.

However, in order to preserve equity throughout it is practical to endorse on each consumer's card a number of units to be used each month, after which a return will be made to the consumer of the difference between one cent and the rate at which energy is being paid for. Thus, if 250 units per month at 2 cents per unit is considered a fair return for a cooking and lighting supply, a refund of 50 cents would be made if 300 units were found to have been consumed. This appears to be the most practical method of adjusting charges under the prepayment system.

Jersey City Industrial Plants Use Central-Station Service.

Following the recent decision of the Crucible Steel Company of America, Jersey City, N. J., to operate under central-station service, and the inauguration of such a plan in May, the P. Lorillard Company has announced its intention of abolishing its power plant used for its down-town buildings for the past fifteen years. A contract has been entered into with the Public Service Electric Company for furnishing electric energy for light and power; this company also supplies the Crucible Steel Company.

New York Edison Exhibit.

Every known method for the treatment of disease by electricity is shown at an exhibition of electrotherapeutics and electrodentistry, in the showrooms of The New York Edison Company. About six hundred medical devices and instruments, in which electric current is used, have been collected, and are shown in operation by specialists in their use. The purpose is to let the public know what is being done by electricity in the medical world. There are X-ray, high-frequency, galvanic and faradic machines, magnetic-wave generators, cauteries, diagnostic instruments, mercury-vapor lamps, and, in fact, every known electromedical device. X-ray photographs are taken for dentists bringing in patients, the negatives being immediately developed.

Electric Suggestions.

A recent innovation in show-window display at the various district offices of The New York Edison Company was attended by exceedingly satisfactory results.

The housewifely custom of setting aside each day of the week for the performance of a special domestic duty was capitalized to good effect. Monday for instance is recognized the world over as the day when the wash tub is the hub of the universe. Every Monday a card was displayed calling attention to the various motor-driven washing appliances. The next day the card was changed to point out the different types of laundering appliances. A motor-driven sewing machine was the center of Wednesday exhibits.

A chafing dish, a tea samovar and a coffee percolator were among the suggestions for Thursday—visiting day, while a motor-driven vacuum cleaner was indicated as the proper thing for cleaning on Friday. Saturday—baking day—was turned over to the chef, and an electric range displayed the advantage of cooking by electricity.

This method of advertising the advantages of the household uses of electricity was inaugurated at the Forty-second Street office and after having been repeated was transferred to the various other offices of the company. It was very successful.

Electrical Construction

POWER SUPPLY FOR MOTION-PICTURE MACHINES.

By A. C. Davis.

The cinematograph has apparently firmly established itself as a part of our national life. The earlier assertions that it was merely a fad of which the public would soon weary, are completely negatived by the ever increasing number of show houses offering motion pictures as the principal attraction. Nearly every small town has its motion-picture house and cities of any considerable size usually support several. These pictures may be hard on the eyes, but their educational and amusement value is unquestionable.

Recent improvements in apparatus and methods for supplying and regulating current for the powerful arc of the machine, do much to improve the clearness and detail of the projected image as well as to eliminate the trying flicker and pulsating intensity noticeable when cruder apparatus was in use.

The diversity of the many types of current-transforming and regulating devices now on the market often lead to confusion in attempting to make a choice. In fact, the lack of definite knowledge by the operators of the technical side of the proposition and the consequent incomplete information furnished to the manufacturers of electrical apparatus of the exact requirements to be met in specific cases, has in several instances led to furnishing more or less unsuitable equipment, resulting in dissatisfaction and subsequent alterations or changes.

The principal requirement in any case is to secure a satisfactory minimum illumination on the screen. It is hence well to bear in mind that the average candlepower for moving picture projectors depends upon: (1), size of the picture; (2), distance of lantern from screen; (3), density or tinting of the film; (4), material of the curtain; the candlepower required at the arc is directly proportional to the illuminated area of the screen and the distance of the projector from the same.

Although the density of ordinary black and white films varies to a certain extent, this is not ordinarily a serious matter, and moreover variations of this kind are often not more than a necessary means of securing the effect of night scenes, clouded atmosphere, etc., and are by no means defects to

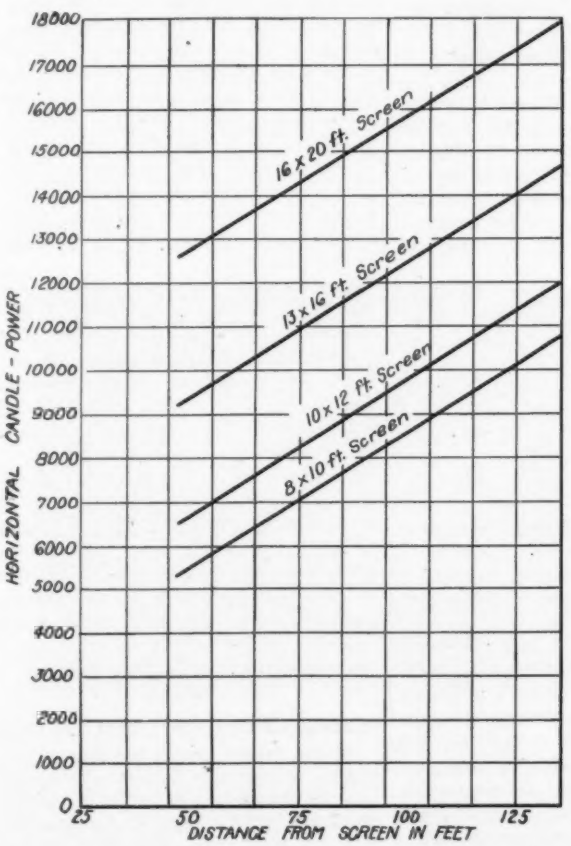


Fig. 1.—Relation Between Candlepower Required and Distance from Screen.

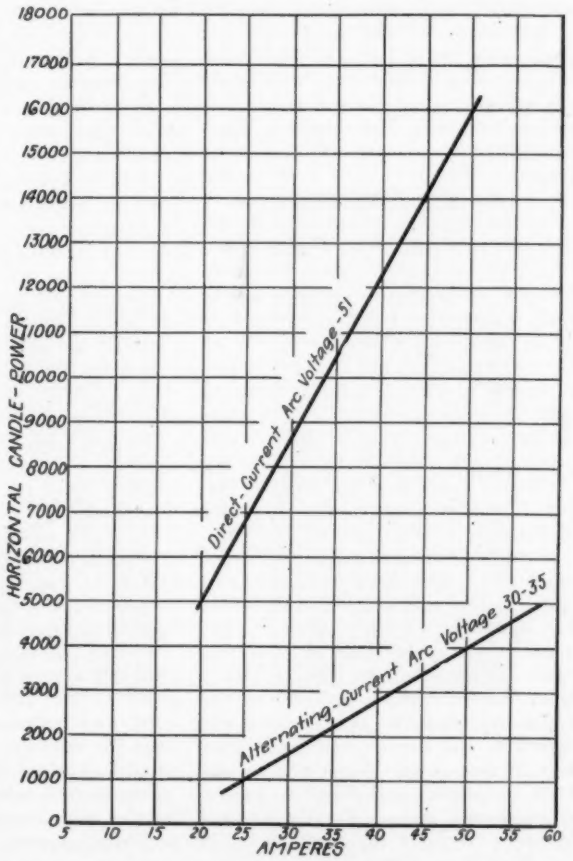


Fig. 2.—Candlepower of Alternating and Direct-Current Arcs for Projecting Lamps.

be modified by candlepower adjustments. Tinted films, or the use of color screens, as in the Kinemacolor machines, may require two or three times as much light as the ordinary black and white film.

The following formula will give approximately the candlepower which should be supplied for the projecting lantern using standard films and muslin or semi-reflecting screens. Mirror screens will be found to require approximately 80 per cent of the value given by the formula

$$C=30A+60D$$

In this formula, C is the horizontal candlepower required; A is the illuminated area of the screen in square feet; and D is the distance from projector to the screen in feet.

It should be noted that the term "60 D" of the above formula represents the amount of the illumination required to overcome the obscuring effect of dust, vapor, smoke, etc., in the air and is an important factor in determining the amount of current which the lantern will require. The curves in Fig. 1 are plotted from the above formula for several common sizes of screens and for the ordinary range of distances.

For alternating-current arcs in ordinary use about the best light is obtained by using five-eights-inch cored carbons set approximately in line with each other and inclined backward at an angle of nearly 30 degrees. In an alternating-current arc the light source is found on the incandescent tips of both the upper and lower electrodes, which are accordingly left fairly close together in order to secure a nearer approach to point illumination, thus taking a relatively high current at the moderate arc voltage of 30 to 35 volts.

For direct current a good combination consists of a five-eighths-inch cored carbon for the positive or upper electrode and a half-inch solid carbon for the negative or lower electrode. In this case the illumination comes chiefly from the heated anode spot on the upper carbon. The two carbons are, therefore, run farther apart, requiring less current at the higher arc voltage of 50 to 60 volts, and the lower carbon is commonly drawn slightly forward in order to form the anode spot on the front side of the anode tip. The curves in Fig. 2 show the horizontal candlepower of alternating-current and direct-current arcs under favorable conditions.

Whatever method of supplying current may be chosen, it will be necessary to guard against the natural tendency of the current in the arc to fluctuate, as well as to prevent its reaching excessively high values when the arc is struck. This may be accomplished by the use of series resistance or reactance or, when the current is supplied from special generators, by employing a differentially compounded field. The effect produced by the use of these devices is that if the current suddenly begins to increase the arc voltage is immediately reduced, or vice versa, thus tending to maintain the current close to its normal value. The differentially wound field of a special generator for motion-picture work accomplishes a similar purpose without actual loss of power, so that when only one arc is to be run from such a machine its voltage may be set for the desired arc voltage.

In practice many motion-picture houses at times desire to operate two spot-lights at once from the same source. In this case it becomes necessary to use a ballast resistance in series with each arc giving a voltage drop of approximately 15 or 20 volts. Special generators or other apparatus intended for this service must, therefore, have an extra voltage capacity of this amount.

The following list includes practically all the common methods of supplying current for the projector arc.

(1). Direct supply from a central station's alternating-current power circuit using series reactance for reducing the line voltage to the pressure required at the arc.

(2). Supply from standard-voltage alternating-current circuits using transformers instead of reactance for reducing the voltage.

(3). Direct supply from a central station's direct-current circuit using series resistance for reducing the voltage.

(4). Pulsating current from the mercury-arc rectifier.

(5). Direct current from special generating apparatus, that is, motor-generator set, rotary converter or engine-driven generator when central-station current is not available.

Alternating current taken directly from lighting circuits is very conveniently secured and requires a minimum outlay for apparatus. Using a reactance for reducing the voltage has the disadvantage of causing a very low power-factor, to which the central station is likely to seriously object, and of being somewhat inconvenient as regards regulation of the arc voltage. By using a transformer in place of the reactance a good power-factor is secured, while most commercial types provide, by means of taps on the winding and a regulating switch, for a fair degree of convenient adjustment. The alternating-current arc, however, does not furnish a quality of light consistent with the modern standards in this art, the light having a decided reddish tinge as well as a trying flicker and tendency to pulsate.

When approximation to continuous current is secured by the use of mercury-arc rectifiers a much better quality of light is furnished than by alternating current, giving at the same time an arc which consumes fewer watts per candlepower. The ordinary commercial rectifier, moreover, is economical in first cost and provides a fair degree of convenient voltage regulation. The wattage consumption for a given candlepower is fully as low as for any other type of outfit. The maintenance costs are, however, apt to be high due to possible breakage and ultimate deterioration of the tubes.

It is stated by experienced operators that the light secured from a purely direct-current source is distinctly superior to any other. The wattage consumption when current is taken from lighting circuits is necessarily high due to a loss in the series resistance. This is partially compensated for, however, by the saving in first cost of apparatus. The same results can, however, be secured with much better efficiency by the use of a motor-generator set, and where alternating current only is available, by the use of a motor-generator set or rotary converter. These have a relatively high first cost, low upkeep, very convenient regulation, and a power consumption practically as low as the rectifier.

In conclusion it may be pointed out that each of the types of apparatus above described has its peculiar field of usefulness. The larger houses doing a long-hour business should have the best and most economical operating equipment, and the first cost becomes a matter of minor importance. For smaller houses or for machines in occasional use a cheaper form of apparatus should be used, even though the operating efficiency may be inferior. Such disadvantages as inferior quality of light due to the use of an alternating-current arc will often be counterbalanced by the decrease in the first cost of equipment.

Kansas Contractors Elect Officers.

At the recent annual meeting of the Kansas Electrical Contractors' Association the following officers were elected: President, E. L. Staley; vice-president, I. C. Bushong; treasurer, J. R. Woodhouse; secretary and national representative, J. A. Mercer.

Contractors' Club in Dayton.

An electrical contractors' club was recently organized by the electrical contractors of Dayton, O. Mr. Wollaston, of Wollaston & Waxler, was elected president and Charles Hall, secretary.

What are claimed to be the best arc-lamp electrodes are made from charcoal obtained in the distillation of peat.

ELEVATOR-SIGNAL SYSTEMS.

Circuits for Auxiliary Signal Devices.

Previous articles[1] have described in detail a number of the elevator-signal systems employed in buildings of different types. In many cases, however, these systems are modified by the addition of devices which permit the indication of the movement of a car or a group of cars and by devices which permit either an intelligent dispatching of cars or an entirely automatic dispatching of cars.

Electric Light Indicator.

It is often necessary to have some means of indicating the movement of a car in the shaft. This is generally accomplished by means of electric or mechanical indicators mounted above the doors on the floors where such indications are desirable. Fig. 1 shows a typical electric-light indicator which consists of an electric light on the indicator to represent each floor, the lamps being so wired and controlled that the movement of the elevator is indicated by the lighting of the corresponding lamps as the elevator passes the various floors. With the modern systems of elevator signaling such indicators are generally only located on the main floor of a building so as to give the elevator dispatcher information regarding the positions of the various cars. However, in some cases they are installed on all floors as a convenience for the passengers.

Fig. 1.—Electric Light Indicator.

These indicators are wired and controlled in the same manner as the position indicator shown in Fig. 3, except that the latter device indicates the movement of a bank of cars.

Electric Position Indicator.

In the Chicago City Hall the density of elevator traffic is such that means are necessary for letting the elevator dispatcher see at a glance the positions of all the cars in a bank. For this purpose the Elevator Supply & Repair Company, of New York and Chicago, installed one of its electric position indicators. Such an indicator is shown in Fig. 3 and consists of vertical rows of lamps each row representing one elevator. Each lamp in a row corresponds to a floor and the movement of an elevator is indicated on the corresponding row of lamps by the lighting of the lamps corresponding to the floor which is being passed. The illustration also shows a horizontal row of push buttons at the bottom of the panel. These control the starting signals which will be described later.

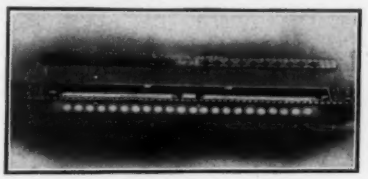


Fig. 2.—Illuminated Threshold.

For the purpose of description each row of lamps in a position indicator may be regarded as corresponding to an electric light indicator for one car as previously described, and each device is wired and controlled in the same manner. In the hatchway for each elevator a vertical piece of slate is installed near the bottom of the shaft. On this piece of slate are mounted a brass strip *B* and a number of brass segments *C*, there being as many segments as there are floors served by the elevator. Each of these segments is connected to one terminal of the corresponding lamp in the position indicator as shown in Fig. 4. The other lamp terminals are connected to a common return which leads to the generator supplying the current for the lamps, the other terminal of the generator being connected to the strip *B*.

A pair of sliding brushes connecting the successive segments *C* of the piece of slate to the strip *B* is caused to move up and down in front of the piece of slate with a movement which is proportional to the movement of the corresponding car. This movement of the brushes is effected by an attached steel tape which is carried up the shaft to the reduction gearing installed in the pent house for the operation of the ordinary floor-lamp signals. It is hence obvious that as the brushes have a movement proportional to the movement of the corresponding elevator, the lighting of the indicator lamps will indicate the movement of the car, for the brushes serve the purpose of completing the various lamp signal circuits as can easily be seen from the diagram. A separate commutator must, of course, be installed for each car. The difference between the electric position indicator shown in Fig. 3 and the electric-light indicator shown in Fig. 1, when considered from the electrical point of view, is only the difference between grouping the lamps for all elevators and the isolation of the lamps for each car.

Fig. 3.—Electric Position Indicator.

Starter's Signal.

The pushbuttons shown near the bottom of the panel in Fig. 3 are designed to permit the elevator dispatcher or starter, as he is commonly called, to control the movement of all the elevators from his post at the position-indicator panel. A buzzer is installed in each car and connected in the same manner as an electric bell to the pushbuttons on the starter's panel, there being a pushbutton for each elevator. By means of a prearranged code of signals the starter has complete supervision of the cars at all times.

1 Contained in issues for January 18 and February 8, 1913 and March 28 and May 23, 1914.

Automatic Timing Device.

The human element in the dispatching of cars may be dispensed with by employing a mechanical starting device. Such a device should be arranged to give starting signals at such intervals as will cause the cars to move in the most logical manner. When only two cars are employed the logical method of dispatching them would be to dispatch them simultaneously from the top and bottom of the shafts, one car being at the top of its shaft when the other is at the bottom of its shaft. Similiarly when three cars are employed one car should start from the bottom of its shaft and another from the top of its shaft when the third car is at the middle of its shaft. An electric-bell signal in which the bell rings at periodic intervals of time, the period being determined by trial, is hence the only device necessary. The device hence consists of a stationary brush and a rotating contact member for closing the bell circuit at periodic intervals. The rotating contact is driven through a disk. This disk is driven through a friction disk which can be caused to bear on the contact-driving disk at any distance from the center of the disk by merely sliding the friction disk along its shaft. The shaft of the friction disk is driven by a motor operating on the current used for lighting the cars, the motor being connected to the shaft carrying the friction disk through reduction gearing. This device is mounted in the pent house and the variation of the time interval for the operation of the bell signal is, of course, obtained by varying the position of the friction disk on the disk driving the contact-making member, the time interval between signals being shortened by moving the friction disk nearer the center of the driven disk. The signal bell is installed in one of the shafts and can be heard by all car operatives. Where more than one bank of elevators is employed the signal bells for the other banks may be operated by placing additional contacts on the device described. This system of dispatching is employed in Butler Brothers' Building, Chicago, and was installed by the Elevator Supply & Repair Company.

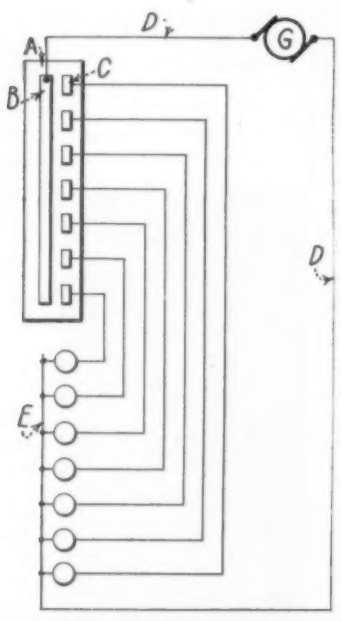


Fig. 4.—Wiring Connections for Elevator Position Indicator.

Safety Devices.

Among the safety devices made by this company is an elevator threshhold light. When this device is only lighted when the elevator stops at a landing, it is controlled by a centrifugal contact-making device located in the pent house, cables being run to the car to carry the necessary current.

The contact-making door or electric car-locking switch is a device which prevents the movement of the elevator while a door is open for that shaft. Contacts are provided on each door being so arranged that no contact is made until the doors are fully closed. These contacts for the various floors are wired in series and are in series with the motor-control circuit thus preventing a closed circuit as long as an elevator door is open.

Missouri Contractors' Meeting.

The fourteenth annual meeting of the Electrical Contractors' Association of State of Missouri was held in St. Louis, Mo., July 11, 1914, the meeting being called to order at 2:30 p. m.

The following officers were elected for the year 1914-15:

Ernest S. Cowie, of Kansas City, president.

William A. Koeneman, of St. Louis, vice-president.

W. C. Cook, of Kansas City, sergeant at arms.

George Carrao, of St. Louis, state director.

A. Penn Denton, of Kansas City, treasurer.

A. J. Burns, of Kansas City, secretary.

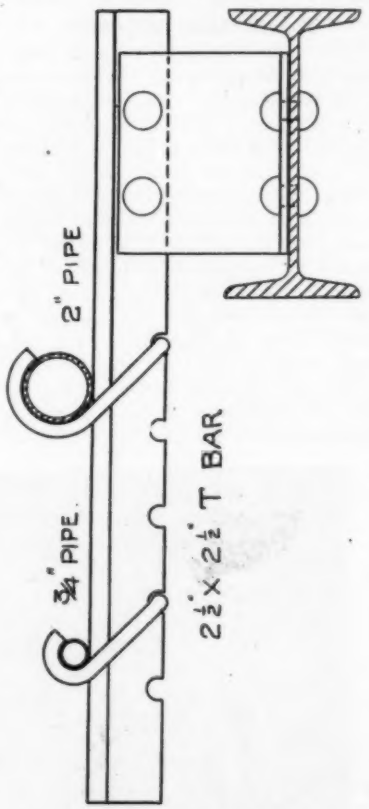
A committee was revived to secure legislation by the State looking to the bettering of conditions relating to electrical contracting. It was the expressed opinion of the members present that a program for the next meeting be provided by the secretary, the program being of such nature as to be of interest and of an educational value to the members.

The next meeting is to be held in Kansas City, Mo., on December 19

Conduit Supports.

In the shops at Balboa, the Pacific terminus of the Panama Canal, a permanent system of supports for large numbers of air, steam, oil, water and electric pipes was necessary. The 2.5 x2.5-T-bar support, illustrated by the sketch, was adopted as standard.

The pipes in general run through the buildings in groups along column lines, and are, therefore, most conveniently located in a vertical plane, one above the other.



Supports for Conduits.

The support consists of a T bar with semicircular punchings in the edge of the web, spaced according to the number and size of the pipes, and a double hook bent up of round stock to straddle the T bar and to fit the pipes. In the normal carrying position the hooks extend more than half-way around the pipes, and so clutch the pipes that they cannot be removed without being lifted vertically several inches. Other connections to the building steel than shown will suggest themselves for individual cases.

This support saved a great deal of labor in the installation of the piping systems. The design and construction of the shop buildings was under the supervision of Lieutenant-Colonel T. C. Dickson.

Arthur Halsted.

Competition and the Electrical Contractor.

The following excerpt from a trade publication puts the subject of competition in an interesting form, and contains suggestions for the contractor:

"The average man in any business works blindly, going through the daily routine without really thinking—a process termed 'reflex action' by psychologists. The unusual man is ever alert to break away from the ordinary—to do new things in a new way. This is what makes him unusual, and this is one thing that makes him successful. You will notice that while others are crying 'competition' he is going ahead in his usual way and succeeding. He has a monopoly, and to him competition is a phantom.

"Take the case of the electrical contractor. The writer knows from experience that it takes at least two hours to solicit and estimate a wiring installation for a cottage—say a $30 job. Probably seven or eight other contractors are figuring, for they are all eager for this kind of work. If this is the case, the contractor with a little prestige has one chance in five of getting the order. If he can get it at a price which will allow him to clear 10 per cent net, he is fortunate. He will probably get his money in ninety days. This is competition.

"The unusual man ignores this and pushes a specialty. With no more effort or time, he will solicit and land an order for show-window equipment. He has no one to outguess; his profit is considerably over 10 per cent, and he gets his money almost immediately, leaving the decks clear for the next undertaking. Besides, he leaves a satisfied customer who will be influential toward another order. This man has no competition by virtue of his monopoly, and his monopoly consists simply in his being awake. To him competition is a phantom—the shadow of something that doesn't exist. The successful druggist, garage man, fruit vender, jeweler or shoemaker is getting ahead by the same tactics.

"The electrical game is one of the best, and it is getting better every day. Every new achievement of the laboratory opens new opportunities to the dealer. The laymen depend on him to keep them posted—they need the new things as they come out, and are willing to pay for them. Yet the average dealer absolutely refuses to see this opportunity. His only chance, as he sees it, is to do the old things in the old way, and his last cry will be that competition is so keen that he cannot make a living.

"All of the above is a very frank analysis of two types of men—the man who runs in a rut, who cannot see over the wall of prejudice, and who is haunted by the phantom; and the man who moves about with his eyes open. The pitiable condition of the wilfully blind man only makes the achievements of the other type easier."

Relations of Electrical Engineer to Client and Contractor.

In discussing the relations of the electrical engineer, in *The Electrical News*, F. R. Ewart has the following to say regarding the electrical contractor.

The contractor may benefit quite as much as the client from the work of the engineer. In the first place, it insures fairness of competition. In tendering he knows that he is figuring on a clear-cut proposition and that every competitor will be compelled to figure on the same thing. As the requirements are laid clearly before him, he spends much less time in making up his bid than if he were uncertain on many points. The loss then in case of failure to obtain the contract is reduced to a minimum. He is also spared the necessity of doing a lot of gratis work. So often a contractor is forced to make plans and specifications of his own in order to show what he is tendering on. The expense of this is unwarranted even when successful and when he fails to land the business it means a bad loss. It also means that he is frequently shouldering the responsibility for details that should not properly be his.

The successful contractor can handle the work to much better effect than in the ordinary case. Losses of time due to uncertainty will be negligible. As the work is started and carried through as a whole, instead of working from point to point, a considerable economy of labor is generally realized. Superintendence expense will also be reduced. The contractor will not have to appear personally on the work several times every day to see that his foreman has not been compelled to suspend the work through uncertainty of the proper procedure.

It is obvious that careful engineering work will improve the caliber of the installation. The contractor can feel, therefore, that his reputation is certainly not suffering through association with a creditable job. If difficulties arise in the work and changes are required that call for extra compensation, the contractor can readily satisfy the engineer as to the justice of his claim. The client alone is often unduly suspicious and hard to handle.

All the dealings between engineer and client must be in the open. To get the best results, the client must take the engineer into his confidence, show him his factory methods clearly and give him a real insight into the workings of his particular business. The engineer, on the other hand, must keep the client advised of what he is doing and his reasons for doing so. He cannot afford, for instance, to accept commissions from dealers or manufacturers, unless the client agrees and the amount is credited towards the fees. In matter of this nature there is no better guide than the Code of Ethics of the American Institute of Electrical Engineers. The engineer will often find, too, that it is a difficult matter to convince the client of the correctness of his methods along some lines. In such cases, he must fight hard to win his point. If the work is not of the best in the end the fact that he has been overruled in many points will help the engineer's reputation very little. The responsibility is his, and the task of convincing his client is part of it.

Among the Contractors.

Herman Andrae Electrical Company, Milwaukee, Wis., which makes a specialty of work for post office buildings, has recently closed contracts for the post offices at Brookfield, Mo.; Sycamore, Ill., and Wooster, O. Similar work is now being conducted in 19 different states.

The Grossman Electric Company, formerly located at 1532 South Fourth Street, Philadelphia, Pa., has been forced to seek larger quarters at 1331 South Fifth Street, Philadelphia, as a result of its constantly increasing business.

The Southern Electric Company, to do a general electrical contracting business and to retail fixtures, etc., is being organized in Louisville, Ky., and will occupy the building at 234 South Eighth Street. Articles of incorporation will be filed shortly.

The Inter-Mountain Electric Company, of Salt Lake City, Utah, has started construction work on the electrical wiring and equipment of the new bank building and hotel being erected in Logan, Utah, by the Thatcher Bros. Banking Company, replacing the former bank building which burned down a year ago.

The contract for the electrical work in the new Y. M. C. A. Building at Alton, Ill., has been awarded to the Ellis Electrical Company, of that city, for $1,363.31.

Thirteen motors aggregating 90 horsepower will be installed at the plant of the Continental Can Company, 4619 Grand Avenue, Chicago, Ill., by the C. G. Rush Company, of that city.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, President, 59 Deerfield Avenue, Hartford, Conn.
H. S. WYNKOOP, Vice-President, Municipal Building, New York, N. Y.
WILLIAM LINCOLN SMITH, Secretary and Treasurer, Concord, Mass.
JAMES E. COLE, Representative on Electrical Committee of National Fire Protection Association, 11 Wareham Street, Boston, Mass.

Executive Committee
EUGENE N. DAVIS, Chairman, Brookline, Mass.

SECTION REPRESENTATIVES:
C. H. Fletcher, H. Burnes, British Columbia.
A. W. Hopkins, G. W. Perry, Western New England.
Washington Devereux, A. H. Lilley, Philadelphia.
E. N. Davis, H. A. Knight, Eastern Massachusetts.
C. A. Hannan, O. E. Smith, New York City.
C. W. Mitchell, John W. Carrell, California.

MEMBERS AT LARGE:
George L. Collison, Frank R. Daniel, James H. Fenton, F. G. Hartwell, J. E. Latta, James R. McCarthy, Thomas D. MacColl, A. A. Moffitt, R. P. Strong

"LET THE CODE DECIDE."

Secretary's Message.

The Sections are now presumably skipping meetings till fall, at least the Secretary has received no word this month as to their activities, nor as to summer arrangements.

The Eastern Massachusetts Section met on June 25 at New Bedford by invitation of Inspector William P. Briggs, chairman of its executive committee. Twelve of the members were present. At the business meeting it was voted to suspend meetings till September. Applications for membership were received from three gentlemen, and a letter of sympathy was sent Inspector John Pownall, of Waltham, Mass., who has been ill for some time and who is now in the White Mountains for his health. The party arrived by train at 10:30 a. m., and were received by Mr. Briggs, the party being conducted to automobiles very courteously supplied by the local public-service corporations. Visits of inspection were made to the Soule Mill, which is entirely electrically operated, and to the station of the Union Street Railway Company. After these visits the party was taken to Whitfield's, at Fort Phoenix, where they enjoyed a clambake and other good things. Here they had as guests Messrs. E. W. Cole, of the New Bedford Gas & Edison Light Company; W. F. Smart and W. L. Fitzgerald, of the Southern Massachusetts Telephone Company; J. M. Hughes of the Automatic Telephone Company, and R. H. Bennett of the Union Street Railway Company. Through the exertions of President Davis, of Brookline, and Mr. Briggs, who acted as secretary in the absence of Secretary Smith, who was conducting a select family party to the wilds of Maine, the party was forced to discontinue its pleasures and to be guided through the intricacies of a brief business meeting. The afternoon was spent in visiting the central office of the Automatic Telephone Company, and the exchange of the Southern Massachusetts Telephone Company. The party left for home at 5:30 p. m. after a most interesting and enjoyable day.

Members will please notice that a sentence of one of the answers is printed in italic type. It is desired that members, and especially Executive Committee members, consider this as a supplementary question and forward the Secretary their ideas on the subject for publication in this department next month.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Necessity for Service Cutout and Service Switch When Subsequent Cutouts and Switches Are Provided.

Question 266. An apartment house has in the basement the meters for the several apartments, each apartment's subservice being protected on the street side of the meter with a cutout and switch. Is the inspector justified in requiring an additional master switch and cutout which shall disconnect and protect all circuits?

Answer 1 (O). Under Rules 23*a* and 24*a*, main cutout and switch should be properly located on the service wires to the building regardless of the switches and cutouts on the submains. If each tenant should be provided with a separate service then the individual cutouts and switches could be located to serve as entrance cutouts and switches under the Code.

Answer 2 (D). Yes, the Code requires a master cutout and switch installed in the nearest accessible place where the wires enter the building.

Answer 3 (Y). Yes, certainly. See Rules 23*a* and 24*a*.

Answer 4 (B). A service cutout and switch should be installed by means of which the entire current for the building may be cut off. The arrangement as indicated would not comply with the rules and requirements.

Answer 5 (P). Yes, the inspector is justified under Rules 23*a* and 24*a*, in demanding this service switch and cutout, it being no concern of his that unnecessary individual switches have been installed to control the various apartment feeders.

Answer 6 (S). I think the intent of Rules 23*a* and 24*a* is that there should be one service switch only, though the inspector might be justified under the rule to allow more than one switch if occasion demands it.

Answer 7 (Q). Switches should be placed on all service wires in the nearest readily accessible place to the point where the wires enter the building. The Code also allows a departure from this rule under special permission in writing which might possibly be applied to the case in question. The inspector would be justified under the Code in demanding additional switch and cutout in the case in question as I take it this is open wiring. There are cases, however, where a master switch and cutout is not entirely practical, for

instance where underground service enters the building with lateral installed in conduit and connected to a metal cabinet with two or more services connected from this lateral for the purpose of furnishing current for separate tenants or for power and lights. Here the special permission could be granted but would advise, however, a master control.

Answer 8 (H). Yes, Rules 23*a* and 24*a* cover the point in question.

Answer 9 (E). I do not understand that each meter in a case like this should have a switch between it and the main but it should, however, have a cutout. Irrespective of the number of meters there should be a main switch which would make it possible to cut off the entire current from the building. Rule 24*a*, second paragraph, makes this plain. While the word "meters" in the rule is plural there is but one service cutout and switch. There are several rules which may be applied in requiring each meter to be protected by its own cutout, but I know of none requiring that each have its switch.

Answer 10 (F). The question is not quite as specific as it might be. Are the switches on the house side of the meters controlling the several apartments? If they are on the street side they would not in our judgment afford the protection demanded by the Code. A master switch should be required which, of course, should be readily accessible. Rule 24*a*, however, clearly provides that the Inspection Department having jurisdiction may depart from the rule but the circumstances which would justify noncompliance with Code regulations would have to be extremely unusual. If the switches for the individual apartments were placed on the house side of the meters, a master switch would positively be required unless for some unusual reason departure from the rule was authorized under special permission in writing.

Answer 11 (A). Rule 24*a* says "a service switch," etc. That does not mean two switches on the meter board. I think the inspector is perfectly justified in calling for the main switch to cut off the entire current, the switch being located near a window or door so it can be reached from outside and cutouts being placed on the meter board controlling each meter.

Answer 12 (U). Rule 24*a* calls for a switch to be placed on all service wires to disconnect all devices. As there is only one service connected to the building I should say one switch and cutout would be required to disconnect the whole building.

Answer 13 (R). Yes, in most cases, but if the meter location is in the nearest readily accessible place to point where wires enter building, if the individual switches are properly protected by the main service cutout, or by individual cutouts, and are so arranged as to disconnect the meters, and if the main service cutout protects all the service wires within the building, then the intent of the Code has been carried out.

Answer 14 (M). The word "switch" as used in Rules 24*a* and 23*a*, is singular and not plural, which would seem to imply that there should be one switch which would disconnect all the wires. However, in case of two or more services there would of necessity be an equal number of service switches required and therefore the inspector might argue the case cited in the question would not perhaps require a main service switch.

Answer 15 (N). This question contains a great deal of food for thought, but the answer under the Code as it stands is perfectly plain. The service must have a cutout at the nearest accessible point to where wires enter the building, and also a switch in the nearest readily accessible place, both devices being installed so as to disconnect all the wires. This requirement is made irrespective of any and all stunts which may be performed with the meter wiring. The inspector therefore is absolutely justified in his demand.

Let us consider the question a little further. There might be two services, one alternating current and the other direct current. It is at least conceivable that such a condition may exist and of course there would be two service switches. Even in such a case I have heard arguments in favor of an installation where the switches are arranged so that the two switches interlock and the opening of one opens the other. I know of at least one case where such an arrangement exists. Such schemes would not apply to a house like this however, which obviously is supposed to have just one service. The condition of separately controlled meters may arise from at least two causes; first, the company supplying current may wish to control each subservice by its own switch which it can lock open where bills are rendered direct to the tenants, and second, where the landlord buys by master meter at one rate and peddles current to the tenants at other and varying rates. Either of these may lead to individual switches which, of course, the Code does not require. I believe, however, that it would be very advisable to apply the Rule 38*a* to many apartment houses and require hall, fire-escape lights, etc., to be tapped off just as in a theater and apply the principles of theater wiring to the control and protection, although the Code does not require it. Some recent fires confirm me in this opinion, and I believe the Code should demand the same construction in hotels and large apartment houses as it does in theaters, the basic reason being the same in both cases. Finally I do not think that the special-permission provision of Rules 23*a* and 24*a* is intended to apply to anything other than a modification of the expressions "nearest accessible" and "nearest readily accessible." Otherwise it seems to me one could justify the entire omission of service cutout and switch, as it is purely a matter of discretion which is a *reduction ad absurdum*.

Use of Gas and Steam Fitters, Elbows In Conduit Work in Concrete Construction.

Question 267. The increasing use of concrete construction brings to us frequent requests to permit the use of gas or steam fitters, 45-degree and other elbows for making conduit turns around the corner of an I-beam, etc. Is such a thing allowed?

Answer 1 (O). Ordinary pipe fittings are not listed as approved conduit fittings.

Answer 2 (D). Forty-five degree elbows would not be approved on account of the sharp edges and abrasion to wires.

Answer 3 (Y). These fittings are not approved and their use would not be allowed.

Answer 4 (B). Elbows referred to in question as "steam fitters' elbows" are not approved for electrical conduit work.

Answer 5 (P). Steam fittings cannot be classed as conduit fittings. They are not properly cleaned and are not provided with internal flanges which will act as bushings against the ends of the pipe. Also, generally speaking, the turns are too short to allow of the proper drawing in of the wire unless the pipe is excessively large for the sizes of wire employed. This request has come to us where the beam is to be encased in concrete and where the bottom of the concrete beam is to carry the outlet. We have refused it as we feel there are several types of pull-box turns which fulfill the need, but in one or two cases architects have been unwilling to permit the *cover* to remain exposed and we have therefore permitted it to be covered in. *We should like to know how this condition is being*

met in other territories, and is there developing a need for a conduit bend that requires less space than the one which is now standard?

Answer 6 (S). No; see Rule 28*h* and 58*g*. There do arise cases, however, where it would be very desirable to use a 45-degree elbow.

Answer 7 (Q). Steam fitters' 45-degree elbows and other fittings are not considered suitable for conduit work as the interior is rough and not provided with the protectve coating inside or outside. Their use is not approved in this territory.

Answer 8 (H). Rule 58*g* provides for bends and does not contemplate the use of steam, water or gas elbows.

Answer 9 (E). The use of steam, water or gas fittings is not permitted irrespective of character or make. Read Rule 58*d* and *g*.

Answer 10 (F). Steam fitters' elbows, unless specially treated to remove roughness, then enameled, plated or sherardized, would not be accepted under Code rulings.

Answer 11 (A). If a contractor asked for an approval of such work, I should say no. First, there is no need for using such fittings and second, they will rake the insulation off your wire while drawing in.

Answer 12 (U). According to Rule 58*g*, I do not see how they can be approved.

Answer 13 (R). Not allowable.

Answer 14 (M). No, Rule 58*g* provides for conduit fittings.

Answer 15 (N). Such fittings cannot be permitted under the Code, though I do think a sharper turn than at present provided is often desired.

Legal Notes

United States Court Decides Against Utah Company.

The Utah Light & Railway Company is enjoined in a decree handed down by Judge John A. Marshall in the United States District Court, from occupying government land with portions of its hydroelectric power works, pipe line, diverting dam and power house in Big Cottonwood Canyon. The decree was based on a decision of the Circuit Court of Appeals in a similar case, that of the United States against the Utah Power & Light Company, reported in 209 Fed., 554. The bill of complaint in the present case was filed in the United States District Court in Salt Lake City by Attorney-General Wickersham, through Hiram E. Booth, then United States district attorney, September 23, 1912, in which the defendant company was charged with operating its electric power plant upon government lands without first having secured a permit from the Secretary of the Interior for the operation of the plant.

The defendant claimed that its right to its reservoir and canals vested under Section 2339 of the Revised Statutes of the United States, and that subsequent legislation does not affect it.

In the case cited above it was determined that the act of May 14, 1896 (29 St., 120), superseded Section 2339 with respect to such rights over public lands for electric power purposes, the beneficial use to which the defendant devotes its water appropriation; that after the passage of that act no right of way could be obtained except pursuant to a permit from the Secretary of the Interior. It was admitted that the defendant had not obtained such a permit, and the question to be determined, therefore, was whether the defendant's right had vested prior to May 14, 1896. These rights were initiated by two notices of appropriation, the one on May 13, 1893, and the other on June 5, 1894, but the reservoir and canals were not completed and water was not in fact diverted until after May 14, 1896. The opinion of the court says: "There is a concurrence of authority that the right to an easement for a ditch or canal over the public land, claimed under Section 2339, only vests on the completion of the work, but that when so completed, as between rival claimants, the title will relate back to the commencement of the work, or notice of appropriation, provided the work was prosecuted with due diligence. This rule of relation, however, has no application against the United States. As to it, prior to the final completion, the appropriator is acting under a revocable license, and cannot complain if the license be withdrawn, even if, as in the instant case, he has expended a large amount of money in expectation of finally obtaining title.

"It may, with force be argued that a statute must be construed as intended to operate prospectively and not retrospectively, if such construction does not clearly violate its language, and that the statute of May 14, 1896, should be held to apply only to future permits. There seems to be no injustice in substituting for an indefined implied license a defined express license, and the act can be properly construed prospectively as providing in effect that no title to an easement should thereafter vest. The object of the act, as determined by the Court of Appeals, was to substitute the permit system for the vested-easement system. If an exception of inchoate rights had been intended it would doubtless have been expressed.

"It is suggested that as the Secretary of the Interior did not promulgate regulations under the act of May 14, 1896, until after the diversion of the water was completed that the defendant's rights are saved. I do not think so.

"The injunction sought by the plaintiff will issue with respect to that part of the defendant's works which are situated on the lands of the United States."

The decree is dated Salt Lake City, Utah, June 29, 1914.

Receivers Named for United States Light & Heating Company.

Receivers were appointed for the United States Light & Heating Company by Judge John R. Hazel in the Federal Court at Buffalo, N. Y., on July 13. The application for the receiver was made by Frederick R. Humpage, one of a committee of three appointed last December by the minority stockholders' committee. The company is said to be solvent. The assets are placed at $3,000,000 and the liabilities at $900,000.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

Coast Valleys Gas & Electric Company. The Commission rendered a decision fixing the rates to be charged the company's consumers in Monterey and vicinity. The company found a reproduction value of its property double that of the estimate of the engineer for the Commission. In the decision, the Commission severely criticises the company's methods in contending for exaggerated "so called values" and in resorting to every known method of loading in order to increase the amount upon which to base a return.

Pacific Gas & Electric Company. In determining reasonable rates to be charged by the Pacific Gas & Electric Company for electric service in the town of Antioch, the Commission adopted the practice, to be followed in fixing rates for companies serving in more than one city, of estimating the cost of generation and transmission to determine a uniform price at the various substations. To this uniform price will be added the cost of distribution within the city. Under this practice the cost to the various distributing centers will be uniform but the cost to the consumer may vary according to distributing costs in different cities.

In its effect upon Antioch, the decision is only locally important, but it is significant in the principle established as it affects other communities whose utilities are subject to the control of the Commission.

So far as Antioch is concerned, the Commission has reduced the top rate for lighting from eight cents for the first 30 kilowatt-hours to seven cents for the first 20 kilowatt-hours.

According to the decision, the following facts are established:

The cost of generating electricity and transmitting it to any community is separated entirely from the local cost of distribution. The cost of electric energy at the gates or border of a community will be constant, but the local cost of distribution will vary according to the size and facilities of a community.

Little weight will be given to values of any corporation as a "going concern," especially to hypothetical estimates of the cost of developing a business.

For the Pacific Gas & Electric Company the constant rate for the delivery of electric energy at a community border is set at 7.312 mills for each kilowatt-hour.

In arriving at its decision the Commission made an extensive investigation of the company's entire hydro-electric system extending from the Sierra to the sea.

After appraising the generating plant, steam plant and transmisson plant of the company, the Commission fixed an approximate value on all of $26,000,000.

The allowances for operation, interest at 8 per cent instead of the 8.5 per cent asked by the company, for depreciation and interest, for operating cost and for power purchased amount to $4,404,556.56.

It is estimated that the company will deliver 602,360,837 kilowatt-hours of energy this year. To meet the cost of generation and transmission, on which the constant rate for delivery at a community border is based, the rate for energy is fixed at 7.312 mills for each kilowatt-hour.

The company held that there should be a return on the basis of the cost to produce its plant plus an allowance for going-concern value.

On this point Commissioner Max Thelen, who wrote the decision, says:

"It may well be urged that where the cost of reproducing the property new is approximately the same as the investment, and the utility has done its full duty in keeping its property up to 100-per-cent efficiency, and has established a proper depreciation fund, the utility may justly claim a return on an estimate of reproduction new.

"The claim, however, that rate-fixing authorities must give a return on the estimated cost of reproduction new without consideration of any other basis, seems to me to be without warrant both in common sense and on authority.

"It will at once occur to a student of public-utility problems that if a plant has been permitted to run down below an efficiency of 100 per cent it may be most unfair to the consumer to allow a return based on the estimated cost of reproducing the property new."

The decision says further:

"A public utility is entitled to a reasonable return upon such money as it has honestly and wisely expended for the public. It should not be allowed a return on money which it has expended dishonestly or without a fair degree of wisdom."

Regarding going-concern value the decision says:

"The best evidence of what should be allowed for developing the business is the amount of money which has actually been expended for that business."

The Commission makes clear that it will give little weight to hypothetical estimates of the cost of developing the business, particularly if the actual facts can be secured, and says:

"The effects of abnormal conditions, bad management, poor judgment, the lack of ordinary care and foresight must be borne by the utility and not by the public."

In reply to an affidavit of the company that it must have a return of 8.5 per cent in order to secure funds for the development of its business the Commission makes a general analysis of the rate of return which should be allowed a public utility, and says:

"In general the rate of return should be such rate as is high enough to secure funds for the development of the business, and in reaching its conclusions on this point the Commission should be liberal in its attitude."

The Commission then proceeds to allow 8 per cent of the estimated cost to reproduce the physical element of the property new as of December 31, 1911, plus an allowance for overhead as determined by the Commission, plus the actual expenditures made for additions and betterments during 1912 and 1913. The Commission declares it has been purposely liberal in its allowance to the company.

The Southern California Edison Company was authorized to purchase 1060 shares of the preferred stock of the Long Beach Consolidated Gas Company at $80 per share. The Long Beach Consolidated Gas Company has issued 850 shares of preferred stock, all of which are owned by the Southern California Edison Company; 5,552 shares out of 6,757 of its common stock are also owned by the Southern California Edison Company.

The Pacific Gas & Electric Company

was authorized to issue bonds as follows: $5,000,000 par value general and refunding mortgage gold bonds, the Commission to determine in a supplemental order the minimum price at which they are to be sold; $12,500,000 par value first preferred stock at not less than $82.50 per share and as much additional as may be necessary to exchange for original preferred stock after July 1, 1916, at the rate of 1.025 shares of first preferred stock in exchange for one share of original preferred stock up to a maximum of $10,000,000; and $1,159,800 par value of common stock for the reimbursement of moneys expended for the retirement of bonds through sinking funds from January 1, 1914, to April 30, 1914, and to provide cash for meeting certain sinking-fund obligations.

ILLINOIS.

The Twin City Light, Heat & Power Company was authorized to put in effect a schedule of rates for electric service in the village of Williamson.

The Mississippi River Power Company has applied to the Commission for authority to issue $4,000,000 of debenture bonds.

INDIANA.

Indianapolis Lighting Companies. The Public Service Commission has completed the appraisals of the Indianapolis Light & Heat Company, the Merchants Heat & Light Company and the People's Light & Heat Company (now merged with the Merchants Company). The work on these appraisals has occupied nearly a year. The Commission's auditing department has also completed an audit of the books and records of the companies.

MASSACHUSETTS.

The Legislature has taken action to refer the matter of the proposed merger of street and elevated railways in and around Boston to the Public Service Commission and further action will be delayed until 1915, when the Commission's finding will be prepared.

MISSOURI.

Standards of Service. The Commission has adopted and published tentative rules prescribing standards for regulation of the service of gas, electric, and water utilities. The companies affected are to file with the Commission on or before July 28 any objections respecting these rules. On July 28 a hearing in this matter will be held before the Commission.

NEW HAMPSHIRE.

Uniform Accounts. The Commission has prescribed a classification of accounts for electric utilities, effective July 1, 1914. Classification of accounts for gas, telephone and water utilities are under consideration and orders will probably be issued within a short time.

NEW YORK.

Discriminations in Telephone Rates. The Commission has rescinded its recent order requiring that all discriminatory rates for telephone service be discontinued. The order was intended to terminate franchise agreements requiring companies to furnish free service to village, town and city officials and other preferential contracts, which were clearly illegal. No hearings were held prior to the making of the order. Subsequently, the Commission found that the scope of the order was so broad as perhaps to include a large number of cases where subscribers affected by the ruling should have an opportunity to be heard. In several instances special circumstances would necessitate suspension orders covering periods of as much as six months. For these reasons, and for the further reason that the pending investigation into the rates for telephone service in New York will afford an excellent opportunity to take up questions of this kind in an orderly way, the Commission has decided to suspend for the present the operation of its order in cases of alleged discrimination and preference.

The New York Telephone Company was ordered to establish on or before July 20 a rate of $33.00 a year for multiparty resident service within the Solvay central-office district and outside the Solvay base-rate area. The subscribers are to have local service in both the Syracuse and Solvay exchanges. This tariff will take the place of the one hitherto enforced by which these subscribers were required to pay a yearly rate of $30.00, a mileage charge from the city limits of Syracuse, and a toll charge of five cents for service to the Solvay exchange.

The Suffolk Light, Heat & Power Company was authorized to issue $72,500 par value of five-per-cent, twenty-year refunding and extension mortgage bonds to be sold at not less than 85 per cent to net $61,623. This sum will be used for the construction of a transmission line connecting the lines of the Long Island Lighting Company at St. James with those of the Suffolk Company at Good Ground.

The Wayne Power Company was authorized to issue $25,000 of capital stock for the construction of a transmission line from Atlanta, Steuben County, to Naples, Ontario County, and for the erection of an overhead distributing system in Naples.

OHIO.

The Ravenna Gas & Electric Company was authorized on July 10 to issue $75,000 of 25-year, six-per-cent bonds to be sold for the highest price obtainable but for not less than par value. The proceeds are to be used for the readjustment of petitioner's bonded indebtedness, for the discharge of floating indebtedness incurred in the construction of additions and improvements, and for the purpose of making further additions and improvements in its plant.

The Harrison Light & Fuel Company. The Commission gave its approval of the purchase of the property of the Harrison Light & Fuel Company by the Octo Oil Company for a consideration of $25,935. The ownership of the Harrison Company carries with it the ownership of 75 per cent of the stock of the Cadiz Gas Company.

OREGON.

Oregon Power Company. The city of Eugene operates a municipal electric lighting and power plant in competition with the Oregon Power Company. Representatives for the city entered a complaint alleging that the company was offering discriminatory rates and special concessions in order to compete with the municipal plant. It appeared, for instance, that defendant had loaned electric flatirons to customers, present or prospective, who agreed to use them, under a written agreement to return them to the defendant when the use ceased. The Commission finds that such practice, open generally to the public, does not constitute an unjust discrimination. Such practice, however, comes within the rules of the Commission relative to the filing of rate schedules, and such practice is held to be a regulation that affects the rates charged for service, and consequently should be included in the schedules filed with the Commission pursuant to its rules. The evidence does not substantiate the complaint of other deviations from the published schedules of the defendant.

The company contended that while it is bound to adhere to its schedules on file with the Commission, the municipally owned utility is under no such restrictions, and is permitted to and does deviate from its schedule at will. The company requested the temporary suspension of its rate schedules as provided by Section 71 of Chapter 279, General Laws of 1911, to permit it to compete on terms of equality with the municipally owned utility.

The Commission issued an order requiring the company to file with the Commission schedules open to the public generally covering the various classes of service now served by it under special contracts, and discontinue charging any other rates than those

contained in its regular tariffs on file with the Commission. The order further states that if the city within ten days from the date of the order adopts a schedule of rates for service where it has in the past deviated from its established schedule, which rates will be adhered to, then the application of the defendant for leave to deviate from its tariffs will be denied; if such suggested regulation is not adopted by the city of Eugene, the Commission retains jurisdiction for the purpose of making an appropriate order relieving the company from the necessity of adhering to its tariffs as to such business.

PENNSYLVANIA.

The Pennsylvania Utilities Company. The petition of the Pennsylvania Utilities Company which sought to prevent the Lehigh Navigation Electric Company from invading its territory in certain parts of Monroe and Northampton counties was dismissed by the Commission. The decision points out that the Lehigh Company was chartered prior to the passage of the Public Utilities Act. The opinion states, however, that when a public service company, acting within its rights granted by its charter, undertakes to make a contract with a municipality, the subject matter of the contract is still within the control of the Commission.

WISCONSIN.

Mosinee Electric Company. The Commission on its own motion investigated the rate to be charged the village of Mosinee for current used to operate the pump at its water plant. A brief cost analysis was made by the Commission and this showed that in the main the schedule proposed by the utility was fair. Some adjustments were made, however, resulting in a slightly lower unit cost than the one proposed.

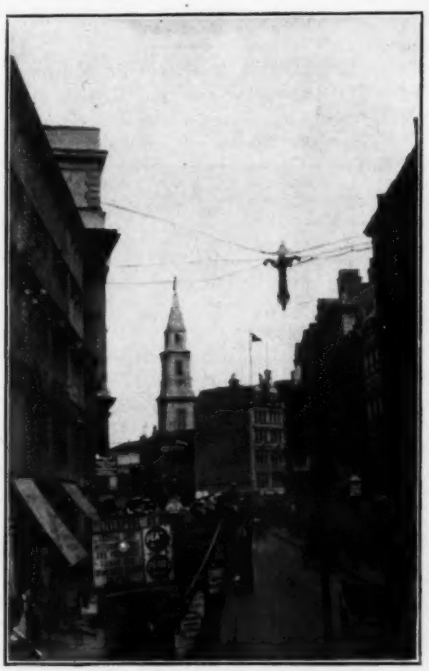
Mosinee Telephone Company. The Commission on July 6 passed upon the application of the Mosinee Telephone Company for authority to increase its rates. The schedule proposed by the company was not adopted entirely by the Commission in its order. In conformity with the statute, the Commission refused to allow the company to make a different rate for subscribers owning telephones than for subscribers not owning such appliances.

New Street Lighting for London.

As the outcome of a careful study of street-lighting installations abroad, the Corporation of the City of London, which has jurisdiction over the "square-mile" embraced in the original city, has adopted a new lighting scheme for its thoroughfares, and this new installation is now being put in, with the prospect of completion in three months.

The units are mostly 2,000-candlepower (with a few 3,000-candlepower) arc lamps of English manufacture knows as the Oliver "Oriflamme," the 2,000-candlepower units being of 11-ampere rating and the 3,000-candlepower 12.5 amperes.

The lamps are mostly suspended from the intersection of two cables, which span the streets and which cross one another at an acute angle of about 45 degrees. In most instances the cable ends are secured to the corners of buildings at the intersection of streets or alleys, and the lamp is thus directly opposite the intersecting street. A Parliamentary act gives the corporation full powers to affix its wires, pipes, lamps and apparatus to the external wall of any building fronting any street in the city, the damage to be determined by agreement or by arbitration after the attachment has been made.



Newgate Street, London, Showing Street-Lighting Equipment.

Conduit and Cutout for Street Lamp.

The average spacing of the new units is about 120 feet, but in certain instances they are not more than 100 feet apart. The whole installation of arc lamps comprises 430; those on Newgate Street, Cheapside and the Poultry, which form a continuous business thoroughfare, have already been installed. The lamps are uniformly 27.5 feet above the street.

A distinctive feature of the Oliver lamp is the Peart dioptric lens, which is contained in the globe, under the arc, and which concentrates the rays horizontally and downwards evenly, deflecting them along the street. There are no dark areas either below or between the units.

At one end of one of the two taut suspension cables is the conduit, secured to the face of the building and leading to the winch box, which is located six feet above the sidewalk. The position of the lamp is controlled by the operation of the winch, one motion bringing the lamp to the footway and another lowering it to within reach of the operator for cleaning and trimming. At the opposite end of the suspension cable is the service conduit of one-inch iron pipe, which incloses the conductor, passing through a cutout installed on the side of the building.

There are also in the "City" 160 75-watt drawn-wire incandescent lamps of round, clear-glass pattern, which are installed each in an acorn-shaped lantern of clear glass attached by a goose-neck arm, two to each of the posts that stand on the islands or refuges in the center of the streets. At important junctions two such posts are located at opposite ends of the refuge, flanking a suspended arc lamp.

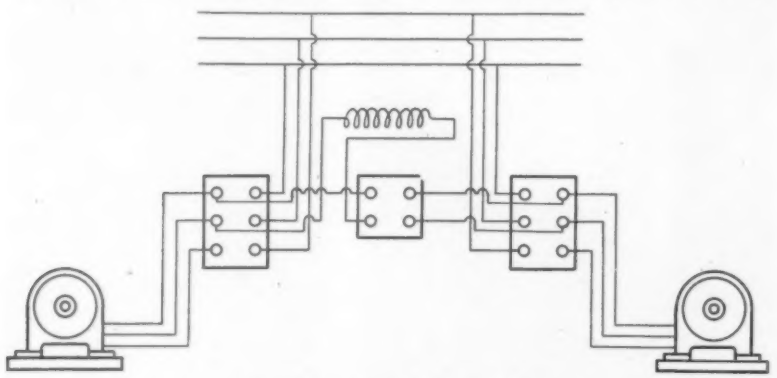
The municipal authorities let the contract for furnishing, installing and maintaining the 2,000-candlepower apparatus and providing current for its operation for a term of ten years, to the City of London Electric Lighting Company, at the rate of £17, or $83.30 per lamp per annum. The contract calls for 4,117 hours of lighting per year, or an average of about 11.3 hours each night.

A Simple Synchronizing Method.

There are many small plants having installations of two or more alternators. Many of these isolated plants or plants in small towns, are operated by a single attendant. This is particularly true of plants having gas engines or fuel-oil engines for prime movers. Synchronizing these units alone is often quite a task, inasmuch as the engines should be controlled while a man is at the switchboard handling the rheostats and switches. If the attendant cannot get assistance it is often a tedious task to get the machines together.

In ordinary synchronizing it is necessary that the voltage of the incoming machine be the same as that of the busbars, also that the incoming machine frequency be exactly the same as that of the line and also that it be in phase. To fulfil these conditions simultaneously requires control of both engine and rheostats, hence the difficulty.

A method is here suggested which does away with the latter two requirements when paralleling alternators. This method will be explained in connection with the accompanying diagram. The alternators are connected in the standard way to their three-pole oil switches. In addition a two-pole auxiliary switch is furnished. This is arranged to connect a single phase of the alternators together, through a current-limiting reactance. The value of this reactance is such that upon short-circuit through it the generator current will not exceed 100 per cent overload.



Simple Method of Synchronizing.

To synchronize, the incoming alternator is brought up to busbar voltage with the two alternators running at speeds to give approximately the same frequency. Now the auxiliary switch is closed. If the units are out of step a momentary single-phase cross current will flow through this switch and the reactance. This cross current will draw the machines into step. The main alternator switch of the incoming unit may then be closed, the incoming engine governor controlled to give proper division of load and the rheostats adjusted to reduce the flow of cross current to a minimum. The auxiliary switch may be opened any time after the main alternator switch is closed.

This method has been used with success in a number of installations. It renders the paralleling of alternators as easy as for direct-current machines. In one case an operator alone started a fuel-oil engine from rest and connected it to the line in two minutes.

The same process can be used for any number of alternators with slight changes of connection, an auxiliary and a main switch being provided for each unit.

Gordon Fox.

Explosions in Electric Mains.

In December last the British Government appointed a committee to consider the causes of explosions which have occurred during the last eleven years in connection with the use of bitumen in laying electric cables; also whether any steps should be taken to prevent explosions in the future from the use of bitumen or similar substances. During the period mentioned seven explosions happened in houses due to the ignition of vapor generated by short-circuits between electric cables laid underground in the streets. Two persons were killed and seven injured. Some ten persons have been injured by explosions due to a similar cause in manholes or street boxes. In addition many minor explosions raised the lids of manholes and disturbed pavements. Other explosions were attributable to electric street boxes containing accumulated coal gas escaped from defective gas mains. All of these cases were investigated fully as they happened, by the electrical adviser to the Board of Trade, and these reports were all before the Committee, which has now completed its labors and issued its conclusions.

It is found that the explosions investigated occurred in connection with electric supply by continuous current through separate cables, for the most part insulated with vulcanized bitumen, and either drawn into bitumen casing or laid solid in troughs filled with bitumen. Further, no serious explosions have occurred where the supply has been alternating current or where concentric or three-core or lead-covered paper-insulated cables have been used, or where cables have been laid solid in pitch compound. A direct comparison between bitumen and pitch compound cannot, however, be made, as the former material has been more extensively used than the latter. In view of the small number of serious explosions that have occurred, compared with the large extent to which vulcanized bitumen cables laid solid in bitumen have been used, the committee does not recommend the Board of Trade to discontinue approval of this system. In view of conflicting opinions of witnesses it is not recommended that iron or stoneware troughing should be used to the exclusion of wood, but it is proposed (1) that wood troughing should be used only where it can be ascertained that the soil is suitable; (2) that where separate mains are laid in troughing each cable should be laid in a separate trough; and (3) that between the troughs there should be a space, not less than two inches, tightly packed with earth or sand.

Further recommendations made by the committee, which, by the way, had before it as witnesses many of the leading electrical experts who have studied the matter from any particular point of view, are these: (1) Separate mains for continuous-current supply should not be laid on the solid system below impervious pavement or close to the walls of houses. (2) Easy bends should be laid at corners and the bitumen or pitch compound should be poured after the straight lengths have cooled. (3) where sharp corners or troughs are suspected to exist the mains should be opened up and the corners eased. (4) Services should be taken into houses (preferably by the use of armored cables) in such a manner that gas cannot enter.

It is urged that central-station engineers should invariably report all occurrences on their systems bearing upon the subject, so that they may be fully investigated and reported upon, the official reports which follow receiving full publicity, so that the number of minds bringing their trained technical intelligence to bear upon the subject may be greatly increased.

Copper was mined in 1913 in Arizona to the value of $63,228,127.

AN UNDEVELOPED FIELD FOR ELECTRIC SIGNS.

By G. D. Crain, Jr.

The growth of electric sign business has been one of the big features of the past few years. This has been largely the result of the co-operation developed between the central station and the sign interests. As a result the central part of most American cities has been lighted up until it is picturesque and effective, as well as a splendid evidence of the interest in advertising by means of illuminated signs.

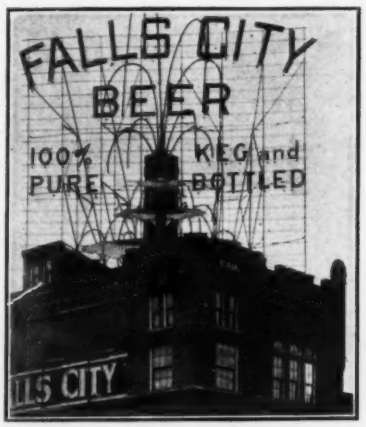
Sign men are beginning to realize, however, that there is a big field which is practically neglected. This is composed of manufacturers whose plants are out of the central district, but are along the lines of railways, and are passed by many trains entering and leaving the city. While most of these concerns have roof signs—an evidence of the fact that they realize the need of publicity and likewise that the passage of these trains, with their thousands of passengers, is an opportunity to secure it—few of them have arranged for illumination for their signs, so that it is only in the daytime that they derive the benefits of their advertising opportunity.

Roof signs are regarded by many sign experts as a good deal more effective than sidewalk signs. The reasons for this are fairly evident. In the congested district of a city, the retail shops adjoin each other, and in these days of progress nearly every shop has its own electric sign. There is a veritable forest of signs, all clamoring for attention, and each in the way of the other. The result is that the signs can be seen only for a short distance in each direction, and their publicity value is therefore limited. It is really becoming a big question, and a problem of no mean proportions among sign men, as to how to place the signs of new customers so that they will show up properly in connection with the signs of neighboring concerns.

That is one reason in favor of developing another field, if it is there, as many electric sign men believe. The efforts which have been put forth jointly by the central station and the sign companies have been directed chiefly to retailers, because the latter are the most obvious prey, and also because such concerns are almost uniformly the customers of the lighting company. In the case of many large industrial concerns which ought to use electric signs, they may either not have been converted to the use of electricity, or they may be making their own current, and in either case they would not be a prospect for the central station. Hence the situation has been most favorable to the development of business among retailers in the downtown districts rather than the manufacturers in the outlying sections.

As far as these are concerned, it is up to the sign men to do the necessary missionary work and bring them in line. Usually it is difficult to convert a manufacturer, who frequently is not a close student of publicity and its value, to the necessity of using an electric sign, especially if he is making a technical product which appeals to comparatively few. That is another reason why the sign-company solicitor would rather spend his time among the merchants, who have their ears to the ground with reference to advertising and business-getting methods, and who listen readily to the proposition of the sign man.

But the manufacturers can be reached, and should be. In addition to the classes referred to, there are many manufacturing concerns which are using central-station current for the operation of their motors, and attention should first be directed to them. After that, the campaign should be extended to the concerns which are using mechanical power exclusively, with a dynamo merely for lighting purposes. It should be comparatively easy to show them the advantages growing out of the installation of equipment sufficiently large to furnish current for a sign as well as ordinary lighting, and in view of the fact that the company is operating its own plant, the cost of maintenance of the sign, once it is installed, is inconsequential.



Conspicuously Mounted Brewery Sign.

The industrial operator who is running his machines with electric motors, but is generating his own current, ought to be easily converted to the value of electricity in the form of an illuminated sign, and all the more so if his location along the railroad is such as to make the announcement effective from the standpoint of "circulation."

"We have done some solicitation among manufacturers whose plants are near railroad tracks, and whose signs would be seen by passengers on the trains," said the manager of a sign company in a large city recently, "but I must admit that the field has not been properly worked, and it is in many ways neglected. The retailer, though a small consumer, compared with what the owner of a big roof sign would be, is so much easier to convince of the merits of sidewalk signs that we have got out of the habit of going after the manufacturers. But in view of the undoubted effectiveness of a big roof sign, which shines out without interference from any competing illuminated space, it looks to me as if there is a splenid opportunity that is being allowed to go to waste."

An example of a sign which is maintained by its owner is that of the Falls City Brewing Company, of Louisville, Ky., which has one of the largest and most spectacular signs in that part of the country. It is on the tracks of the Southern Railway, and is also on lower Broadway, which is a thoroughfare to Shawnee Park; and the sign is therefore visible to railway and street-car passengers, autoists and pedestrians, not to mention the residents of a large area of that part of the city, from which it is easily visible.

The company has had its own power plant, ever since it was established fourteen years ago. A reciprocating steam engine is the prime mover, while a 75-kilowatt direct-current Willey generator provides the electric current. This unit, which was built and installed by the James Clark, Jr., Electric Company, of Louisville, provides current for all of the equipment of the brewery, in addition to lighting the plant and the sign.

The sign, which is 35 by 45 feet in dimensions, is located on the roof of the building, and has a splendid location, as there are no other tall buildings near. It was erected by the Thomas Cusack Company. The design consists of a constantly running fountain, with the words, "Falls City Beer" above it, a catch-line, "100% pure," and then, in red "Keg and Bottled." The reading matter flashes on and off at about 15-second intervals, the flasher being operated by a three-horsepower motor.

There are approximately 1,400 lamps in the sign, of which 1,000 are tungstens. The fountain contains 484 lamps, while the name of the beer is outlined with 275 lamps. A transformer is used to step the pressure down to 60 volts. The smaller lamps are arranged in series.

The sign is mounted on 22-gauge galvanized rolled steel, and is designed to

resist a 90-mile gale. This is necessary, as the sign, as stated, is on the top of a five-story building 80 feet high, and the base of the sign is several feet above the roof.

An interesting feature of the use of this sign, which indicates its value to the central station, is the fact that the company was so impressed with the advertising benefits derived from it that another large sign was erected in the down-town section, this, of course, being operated by current from the Louisville Gas & Electric Company. From this standpoint it is obviously good business to encourage the use of electric signs even among manufacturers who can supply their own current, because of the business which may result in other ways.

Small Hydroelectric Plants in Utah Closed Down.

The power plants of the Utah Power & Light Company in the immediate neighborhood of Lehi, Utah, representing an outlay of more than a half a million dollars, are rapidly being closed up and are expected to remain idle indefinitely. The electric plant at Battle Creek, costing $150,000, has been closed for two months. The one at Alpine, costing $175,000, was closed down last week. The one at the mouth of American Fork canyon and the one two miles up in the canyon will be out of commission after July 1. The four plants have a total capacity of more than 5,000 horsepower.

Sixteen men were employed in the operation of the four plants, but all will be laid off except those necessary to protect the property and see that the water is kept in the long wooden pipe-lines to keep them from falling to pieces. This will require six men.

The closing of the plants does not mean that the electric light and power service of that locality will be impaired in any manner, but that it is a policy of retrenchment being instituted by the power company. When the present owners formed the Utah Power & Light Company they took over 24 plants which had been built by almost as many companies. Each of them had a surplus of power, and when the amalgamation was perfected there was a vast aggregate of power that was not needed.

It is given out on reliable authority that 16 of the 24 plants will be closed and that 8 of the larger ones will be able to supply all the markets now being supplied by the 24 plants.

As fast as the market for electrical energy is developed, the plants will again be placed in operation. It will not be the policy of the company to sell or dispose of any of the closed plants. On the contrary, they will be kept in perfect condition, so that as they are needed they will be ready.

Great Salt Lake Preserves Timbers.

In replacing a railroad trestle recently burned along the north shore of Great Salt Lake, Utah, engineers have just found that the piles are still perfectly sound after 43 years of service. Looking for the cause, since these were only of local pine and fir, they found the timbers were impregnated throughout with salt from the lake.

At another point on the lake, 18-inch piles, set 29 years, are similarly preserved with salt which has penetrated to their very center. Timbers in the Southern Pacific trestles across Salt Lake, placed in 1902, appear to be as good as on the day when the piles were driven. They have been preserved well above the water line by the salt dashed on to them by the waves, a fact apparently anticipated by the engineers who built the trestles.

The first transcontinental telegraph line, built before the railroad, extended west from Salt Lake City through the prosperous mining camps of Eureka, Austin, and Virginia City. When the railroad was built, the telegraph line was transferred to follow its right of way and the old poles sawed off at the ground. An engineer who recently examined the butts left in the ground in the salt desert near Fish Springs found that, although 50 years had passed since the poles were cut off, the old butts were perfectly sound.

Telephone and electric companies in the Salt Lake Valley have used the local salt for preserving poles. When set up, about 75 pounds of salt is placed around the pole on the ground. This method can not be used, however, when the pole is on or near a lawn, or in any place where vegetation is desired.

It is pointed out that the reason why the waters of Salt Lake act as a strong preservative, as distinguished from ocean waters, is because the lake water is so much saltier, being practically a saturated solution. Preservation with salt is of no use in ocean piling against the attack of teredos and other marine borers.

Experts in the United States Forest Service, who have been investigating the preservative treatment of timber, offer the suggestion that ties and poles which have been immersed for some time in the waters of the lake ought to be impervious to decay if the salt is not leached out by the action of the elements. It has been suggested that this can be guarded against, for example, by painting the butt of the pole with a coat of creosote which will keep out the moisture and keep in the salt.

The United States Forest Service estimates that the forests throughout this country cover about 550,000,000 acres.

Electric Lighting of Westminster Abbey.

The "dim religious light" that poets wrote about as pertaining to the interior of the ancient churches of Europe is no longer a characteristic of the famous cathedrals of England, particularly of London. St. Paul's, Southwark and the famous Abbey all have excellent modern electric installations, with illuminating units of the most improved type.

In the early days, candles were of course the sole means of lighting the dark interiors of the vast cathedrals, while in recent times gas has been employed. But modern science has applied itself to religious edifices, in common with those devoted to other uses, so that the historic churches are now cheerful and even brilliant with their electrical equipment.

The present lighting system of Westminster Abbey in London was installed about three years ago in anticipation of the coronation of King George V, and has been somewhat amplified and perfected since, until now it is noteworthy both for its simplicity and its effectiveness.

The whole edifice, apart from the Chapel of Henry VII, is lighted by chandeliers which are pendent from the roof, in the nave, choir and transepts; and from the center of steel rods spanning the aisles. Most of the chandeliers, which are of ornamented brass, contain six 35-watt Osram drawn-wire lamps installed upright and inclosed in frosted, bell-shaped shades.

The nave is provided with two lines of these chandeliers, as shown in the illustration, each line consisting of eight clusters suspended on three-quarter-inch wire cables about 85 feet from the vaulted ceilings—which is 102 feet above the floor—and 15 feet inside the columns supporting the lofty arches of the roof.

The choir has three chandeliers, these being pendent from the central point of the ceiling. Each of the two transepts, north and south, has five chandeliers, which form a line across the church. The sanctuary contains two chandeliers of the same type, midway between the altar rail and the reredos, one on either side, there being also, close to the reredos, two chandeliers of a similar design each containing six candles inclosed in clear bell-shaped chimneys, and at the altar rail there are two brass standards bearing the seven-branched candlesticks with candles inclosed in tall clear-glass chimneys.

Two chandeliers of the uniform type hang over the organ loft, one in front of each section of the great organ, ten feet higher than those in the nave and in line with them.

The exceptions to the prevailing type

of chandelier clusters are found in the aisles which run parallel with the nave and the transepts. Here are four-lamp clusters instead of those composed of six lamps, the type of illuminating unit and shade being the same as in the predominating type of chandeliers. Two of the four-lamp chandeliers are in each of the aisles of the nave, opposite the choir; two in the ambulatory or aisle next the high altar and Edward the Confessor's Chapel, which is just back of the altar; two in the west aisle of the North Transept, and two in the east aisle of the South Transept, known as the Poets' Corner.

The small mortuary chapels grouped about the ambulatories are unlighted except as the light from the chandeliers in the ambulatories is shed over the top or through the grillwork which divides them from the aisle.

The lighting provision in the choir consists of 44 pairs of 17-watt Royal Ediswan units of long, slender shape, which are installed tip to tip in special patented bronze reflectors having circular hoods that can be opened and closed and mounted on brackets over the singers' desks. The units are equally divided between the two opposite sides of the choir, three of the five lines of benches and bookrests on each side being provided with the type of illumination described.

The pulpit before the high altar is likewise provided with a shaded reflector containing two 17-watt units, while the lectern from which the Scriptures are read, is lighted by candles in the plain chimneys such as are employed in the chandeliers before the altar rail.

Passing to the Chapel of Edward the Confessor, which contains the famous Coronation Chair and the tomb of the Confessor, one finds this august place provided with two of the six-lamp chandeliers, while just back of this chapel, at the entrance to the beautiful Chapel of Henry VII, are two of the four-lamp clusters, one on either side of the stairway leading to the chapel and to the tombs of Queen Elizabeth and Mary, Queen of Scots, on either hand.

The last two secluded rooms are not provided with artificial illumination, but Henry VII's Chapel has an installation of 35-watt electrical units of the Osram type, each of the three long bookrests in front of the Knights' Stalls, on opposite sides of this chapel, having at both ends a four-foot bronze standard which supports a single lamp inclosed in a plain ground-glass shade. A like installation is provided for the single-seated desks in the back corners of the chapel.

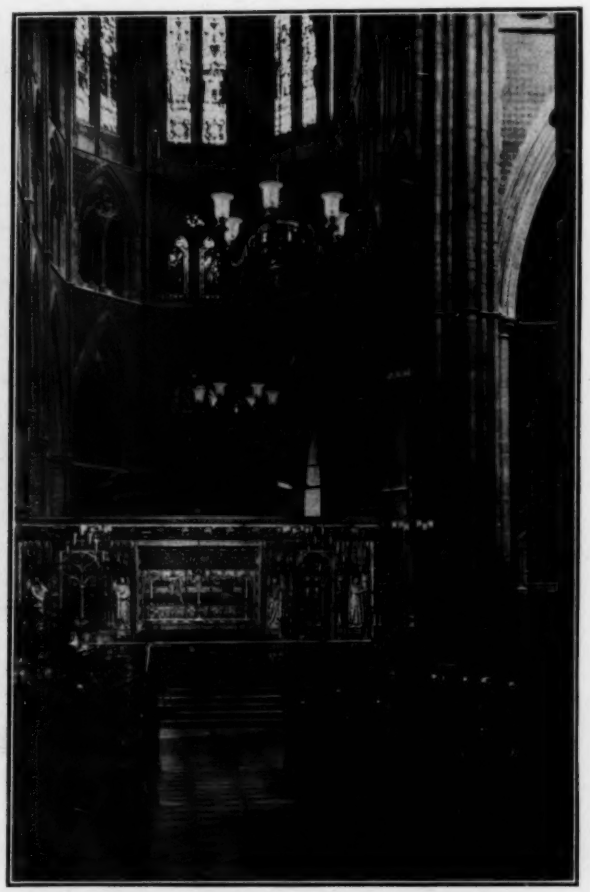
The circuits for the whole edifice are controlled from two glass-fronted switch and fuse boxes located in a room beneath the organ loft, between the choir and the nave, and readily accessible from both. The switches for the church, apart from the desk lamps in the choir, are of the wooden handle type and operate levers which close and open the circuits directly.

There are two switches for general circuits, four for the nave, two for the choir chandeliers, two for each transept, two for the sanctuary, and one for the roof lighting. The circuit controlled by each switch is indicated by white porcelain labels printed with plain black lettering.

Porcelain-contained fuses for these circuits are arranged in a double line, one above and one below the two rows of switches to which they belong.

There are also two secondary switch cabinets, one on either side of the main cabinets, for the control of the

Nave, Westminster Abbey, Showing Two Rows of Electroliers.



Choir and High Altar, Showing Reflector Lamps Over Choir Desks.

reading lamps in the choir. Each of these panels contains eight snap switches and controls one section of the choir. The fuses are located in other glass-fronted cabinets just above the switch boxes on the same wall. A secondary switch box for the Chapel of Henry VII is located near the entrance to this chapel. The Abbey lamps are all operated on 200 volts.

An auxiliary installation of two groups of small gas units on upright standards is provided at either side of the public entrance to the North Transept of the Abbey, next St. Margaret's Church.

While Westminster is open to the public only until about an hour before sundown, daily, services are held Sunday evenings, after dark except during the longest days. On such occasions the full lighting equipment is utilized, the volume of light being varied with the different periods of the service. The control of circuits enables alternate chandeliers to be operated at once, and during time of prayer or congregational singing the full illumination is utilized, while at other periods only a part of the chandeliers are operated. This flexibility of operation greatly enhances the comfort and beauty of the service and makes the Abbey one of the most cheerful of church auditoriums, whereas formerly it was gruesome in the extreme.

The Lighting of Art Galleries and Studios.

An interesting discussion took place at a recent meeting of the Illuminating Engineering Society in London on "The Lighting of Picture Galleries and Art Studios." There was much interchange of opinion as to the desirability of providing general illumination in a gallery, treating all pictures the same irrespective of subject, and local lighting. For the latter it is claimed that a skilful lighting expert, by arranging the direction and quality of light, can accentuate and bring out to the best advantage the intentions of the artist.

Some of the artists that were present at this gathering, however, seemed to view this suggestion with some suspicion. It was agreed that a lighting engineer, acting under the supervision of the artist who painted the picture, might secure good effects. But the artist would not, as a rule, care to leave the interpretation of his picture to the care of any lighting expert, unless he could personally superintend the way the light was arranged. Apart from this the separate treatment of each picture, out of a large collection, is usually hardly practicable.

But it was agreed that, assuming all the pictures to be lighted the same, the usual treatment of the gallery is wrong. It is customary to flood the entire room with light. Spectators and pictures alike are strongly illuminated. People are usually satisfied with this arrangement because visits to many picture shows have their social side; people go to be seen as well as to see—and ladies in particular wish to be seen to advantage.

Now from the artistic standopint this is wrong. The pictures should receive the brightest illumination, the spectators should be in subdued light—just on the same principle as the auditorium in the theater is darkened. Mr. Joseph Pennell mentioned a better method of suspending a central canopy under the skylights in picture galleries so that the light is obstructed immediately underneath, where the spectators stand, but is unchecked at the sides where it falls upon the pictures to the best advantage.

Another matter that was only casually touched upon in the discussion was the lighting of art classrooms and studios. From the sculptor's standpoint the arrangement of the light is of great importance. The shadows must be soft but yet quite distinguishable. The question whether indirect lighting gives the right effect in such cases has been much debated. Indirect arc lighting is used at many of the art classrooms in England and Fig. 1 shows such a room at the Arts and Crafts School, Southampton Row, London.

In the "life" room a general diffused illumination is required for the students, but special lighting should be provided for the model, so that both the intensity and direction can be altered at will. At the Arts and Crafts School a somewhat interesting method is adopted. Two semi-indirect arc lamps are hung very high up near the sides of the room, and the walls and ceilings are white so that there is very complete diffusion.

The local lighting of the model is provided by tungsten lamps mounted in a movable chamber covered with diffusing glass. The box containing the lamps is attached to a rotating arm and can be maneuvered so that the actual source is invisible to the students but throws an extra illumination on the model. It is possible also that the slight difference in color of this light, as compared with that of the arcs, is helpful in aiding the concentration of attention on the model.

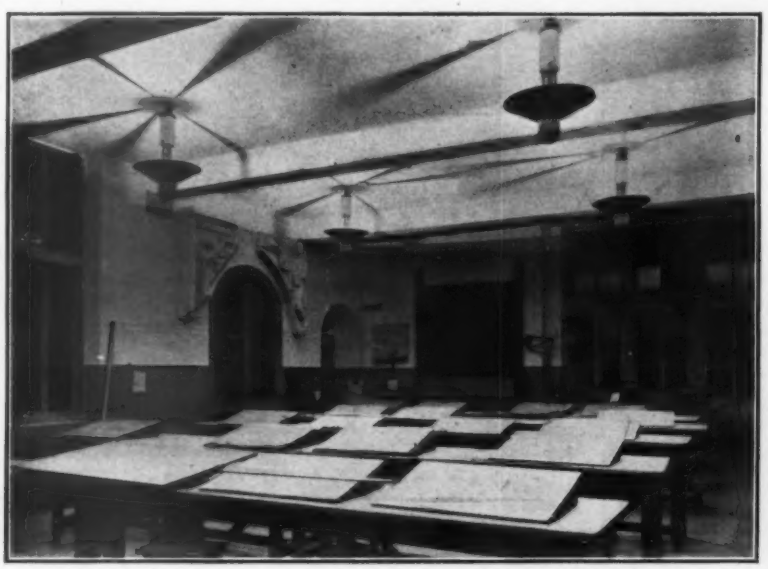


Fig. 1.—Architectural Drafting Room, Arts and Crafts School, London.

Fig. 2.—Life Room, Arts and Crafts School.

BOOK REVIEWS.

"Public Utilities: Their Cost New and Depreciation." By Hammond V. Hayes. New York: D. Van Nostrand Company. Cloth, 262 pages (5½x8½ inches). Supplied by the Electrical Review Publishing Company, Inc., for $2.00.

Everything considered, this is undoubtedly one of the best books on the subject which has been published recently. Naturally some authorities will differ with Mr. Hayes's treatment of the subject. Mr. Hayes's profound respect for the courts and commissions has led him to give as conclusions, in most cases, the prevailing practice and conclusions of the courts and commissions in the past rather than express his own conclusions, gained from his own extended experience and observations on the subject. This method of treatment is, unquestionably, a safer guide for those just beginning the study of the subject, but at this time, when there is such a wide difference of opinion of the courts and regulating bodies, Mr. Hayes could, unquestionably, without injustice to himself or reflection upon the judiciary, express his own views on many of the subjects, which would, undoubtedly, bring out viewpoints which would be helpful in making deductions looking toward the establishment of sound principles, which must be deduced and established before proper regulation can become settled, accepted and a uniform practice throughout the country. Nevertheless, his method of treatment and arrangement of the subject is one of the best that has yet been put in print, and is worthy of careful study by all who are interested in this important subject.

HAROLD ALMERT.

"Elementary Theory of Alternate Current Working." By Capt. G. L. Hall. London: The Electrician Printing & Publishing Company, Limited. Cloth, 196 pages (5½x8¼ inches), 130 illustrations. Supplied by the Electrical Review Publishing Company, Inc. for $1.50.

The aim of this book is to present the elementary principles of alternating currents in simple form and to rob electrical phenomena of the mystery with which they are often associated in the beginner's mind, by reducing the principles, as far as possible, to everyday mechanical equivalents. The first five chapters are thus devoted to the general theory of alternating currents. The captions are Alternating Currents, Inductance, Capacity, Resonance, Power Measurements, Polyphase Systems. There is very little in these chapters that distinguishes it from ordinary texts on the same subject. The reviewer is not familiar with the English school system and is thus unable to say whether the elements of the differential and integral calculus are included among the elementary studies. In this country one would ordinarily not expect to find notations of the calculus in an elementary text, which this purports to be. The notation and methods of the calculus are employed in determining the root-mean-square value of a sine function as well as to show that the current changes at the greatest rate when it is passing through zero. Since there are more elementary ways of showing this, the use of the calculus does not seem consistent with the statement in the preface. The reviewer does not wish to be understood as criticizing the use of the calculus, for sooner or later the student will have to become acquainted with its applications, and when the principles are introduced at the beginning of the course less difficulty will be experienced later.

Beginning with Chapter VII, the author discusses, in an elementary way, the fundamental principles of alternating-current machinery. The subjects treated are: Transformers, Generators, Synchronous Motors, Induction and Commutator Motors. Throughout the text the author has given lucid explanations of the physical reactions and quantities. This is especially true of the description of the principles of the commutator motor. The book is well illustrated by diagrams and should be very useful for a short course in alternating-current theory.

C. M. JANSKY.

"Practical Alternating Currents and Alternating-Current Testing." By Charles F. Smith. Fifth edition. Manchester: The Scientific Publishing Company. Cloth, 398 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $2.00.

As the author states in the preface, this book is an attempt to introduce the student to the main principles of alternating currents and alternating-current machinery from an experimental rather than from an abstract, theoretical standpoint. In this respect it meets with the hearty approval of the reviewer, and apparently that of others as well, for this is the fifth edition of the book. The reviewer has for some time been contending that one weakness of our technical instruction is the separation of the teaching of the theoretical and abstract principles from laboratory work. The book before me develops the abstract theory in connection with laboratory exercises and is thus a combination of a theoretical text and laboratory manual. In the development of the subject the author outlines 48 experiments. If the student follows the author's directions he becomes acquainted at first hand, or immediately, with fundamental physical relations, and determines the data upon which theory is based. Such a method is pedagogically sound, for it undoubtedly follows the maxim—from the concrete to the abstract.

The result of efficient teaching must be the development of workable ideas in the student's mind, that is, power of analysis and reasoning must be developed. In order that this may result the accuracy and truth of fundamental principles must be made real by bringing sense material into the field of the student's consciousness, where it may be assimilated and organized into new concepts. The text under review will be a great aid towards accomplishing this end.

It is not necessary to enumerate the subjects discussed in the text, for in this respect it covers about the same ground as other texts on elementary alternating currents. A slight difference is found in the last chapter, where the author discusses the composition and analysis of alternating-current wave forms and describes the Duddell oscillograph.

This is an excellent practical text book. Higher mathematics are conspicuous by their absence. The treatment of the different subjects is clear and the diagrams aid much in simplifying the treatment. It is to be hoped, however, that in a revision of the text the inconsistency of using C and I to represent current, and B and E to represent electromotive force will be changed so as to conform to the recommendation of the International Electrotechnical Commission.

C. M. JANSKY.

"Engineers' Costs and Economical Workshop Production." By Dempster Smith and Philip C. N. Pickworth. Manchester, England: Emmott & Company, Limited. Cloth, 248 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $1.50.

This is a very good book for the general reader who wishes to get a knowledge of how costs are arrived at. It covers the entire field from wage systems to freight rates, cost-keeping to depreciation charges, specifications to standard times. When one considers the size of the book (243 pages) it is surprising how extensive a field it covers.

Naturally the authors do not go deeply into any one of the subjects discussed and it is hard to believe that a worker in any one of these various lines of engineering will get the slightest assistance in his work from this book. A shop foreman would learn nothing about shop management, but he could learn something about how overhead charges are arrived at, and so

clear up that never ending puzzle of the shop man. Why does the firm always double or treble his shop cost in determining the cost of an article? Likewise an accountant may learn that there is a science to shop management.

Naturally, such a comprehensive survey was not written by men who were experts in all lines, so the book bears abundant evidence that the authors gained their knowledge in the library and not in practical work.

The description of the piece-work system, page 43, would never be recognized by a piece-worker. On piece work the worker gets what he earns, and no more. The firm does not pay him his regular wages and deduct the excess at some future time, as stated here. Also, on page 241, the machine allowance on rough shafts 30 diameters in length, are ridiculous. The authors give 1/32 inch in diameter on shafts under one inch. Imagine the waste of time setting up a piece 0.75 inch in diameter by 22 inches long to finish to twenty-two thirty-seconds; it would be cheaper to turn it from a one-inch bar. The allowance given on large shafts are just as far from correct. The authors give 6.75 inches as rough diameter for a shaft to finish 6 inches. The writer knows several parties in the forge business who would like to sell forged shafts at the prevailing price per pound to shops who would accept such an abundance of metal. From 3 to 10 inches diameter the ordinary allowance is three-eighths of an inch. Such absurdities are found in a number of places, yet for all, the writer believes he has learned from this book considerable of the principles underlying the other fellow's work.

F. V. McMullin.

"Molded Electrical Insulation and Plastics." By Emile Hemming. New York: Ward Clausen Company. Cloth, 208 pages (5x7½ inches), illustrated. Supplied by Electrical Review Publishing Company, Inc., for $3.00.

The purpose of this book is to deal thoroughly, and as briefly as possible, with the progress in the field of molded insulation, to trace its development during the last 10 years, and to discuss its present status; to treat of the important basic principles of the new products and inventions, omitting specific trade names; to give the engineer an insight into materials and methods employed in manufacture, disclosing various characteristics both favorable and unfavorable; and so to guide him to a proper selection of the substances best suited to his wants and requirements. The author is an undisputed authority upon the subject of molded electrical insulation and plastics. He has given us here a book which we have badly needed, and which will take its place as a classic in the literature of engineering subjects. Molded insulation material is classified into its various divisions and so described that the engineer may identify the various products which are found commercially available today. The characteristics of the raw materials entering into the processing of molded insulation and plastics are treated with considerable detail, and the reasons why these characteristics make for favorable or unfavorable commercial adaptation under varying conditions are explained. The properties of the various classes of insulation material are dealt with, and the methods of forming the material into commercial shapes are given especial attention. An important and valuable chapter is devoted to the selection of materials in relation to design and uses of insulating parts. There are numerous illustrations showing the multitude of shapes into which molded material is made, and in connection with each division there is a running commentary with respect to the classifications of insulations which, from an engineering and practical point of view, best meet the strains and stresses involved. A carefully arranged index makes for easy reference.

"Switchboards, Switching and Protective Apparatus." By C. C. Adams. Chicago: American School of Correspondence. Cloth, 119 pages (5½x8¼ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $1.00.

This volume discusses principally American practice as displayed in the design and construction of switching and protective apparatus, although a few European types are referred to. It will be of value to the student first of all, but also to the operating engineer who wishes to familiarize himself with a wider range of types than will be found in his own power plant. For the designing engineer and manufacturer there is little, if anything, of value, as the more detailed questions of design are not gone into. For the purposes of the class of readers to whom the book will appeal, it is well written and covers sufficiently well in a brief space the subjects undertaken.

"Electric Motors." By Francis B. Crocker and Morton Arendt. Second edition, revised and enlarged. New York: D. Van Nostrand Company. Cloth, 305 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $2.50.

The new edition contains many amendments and additions to the original, which make the subject more complete. Some sections of the book have been largely revised, such as starting-box calculations, and an entire chapter has been introduced on the power requirements of machine tools, fans, pumping machinery, etc. The authors have treated their subject primarily from the standpoint of operation and have endeavored to make it suitable for the user of motors, the student and the specialist. Matter of theoretical or special interest has been purposely omitted. The subject is, of course, treated in a technical way and the book will be of value to all those interested in the characteristics of different kinds of motors, the methods of control, and the choice of motors for particular uses.

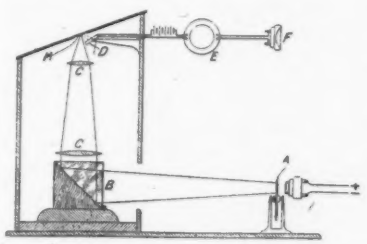
"Handbook on Overhead Line Construction." Compiled by the Subcommittee on Overhead Line Construction. Philadelphia: National Electric Light Association. Leatherette, 819 pages (4½x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $4.00.

This book will be especially useful to the linemen and engineer in charge of overhead construction, for whose use it has been prepared. The first section gives an abridged dictionary of electrical terms and tables of logarithms, conversion tables and other tabular matter. Other sections deal with Distribution and Transmission Line Supports; Conductors and Wire Tables; Cross-Arms, Pins and Pole-Line Hardware; Insulators; Transformers, Induction Regulators and Lightning Phenomena; Systems of Distribution and Transmission; Mechanical Calculation of Transmission and Distribution Lines; Preservative Treatment of Poles and Cross-Arms; Primary and Secondary Line Construction; and Meterological Data. Appended are rules for resuscitation from electric shock. The section on line supports contains the most complete collection of data on wood poles that has ever been published; specifications for poles of different woods; and there are illustrations of the common pole defects. General information on steel and concrete poles is also included. The wire tables include values for inductance, impedance, charging current and capacity for various spacings and different sizes of conductor, and are more complete than any published elsewhere. Methods are given for testing insulators both mechanically and electrically. Lightning arresters, fuses, etc., receive full treatment and there is a statement of the theory and methods of grounding. Complete formulas are given for the solution of sag problems, cross-arm and pole stresses and calculations for strength of guy wires. The section on wood preservation is a reprint of the special committee reports made in 1910 and 1911 and is very complete. This handbook is the first to cover this particular ground in so comprehensive a way and it will be found indispensable to those engaged in this work.

New Electrical and Mechanical Appliances

The Optophone.

At a recent meeting of the Royal Society in London, England, an optophone, invented by Dr. E. E. Fournier D'Albe, was on view. This instrument, which is an example of the ingenious combination of the simple laws of optics, electricity, and acoustics, renders



Scheme of the Optophone.

it possible for a blind person to read ordinary type by ear. For its description and the accompanying diagram, we are indebted to *Electrical Engineering*, of London.

The light from a Nernst lamp passes through the holes in the perforated rotating disk *A*, the prism *B*, and the lenses *C*, which focus it onto the reading desk at M, in the form of a bright line consisting of five dots giving flashes of different frequencies. The paper to be read is placed print-side downwards on the desk, so that this line of recurring dots falls onto the print, and is reflected back onto the selenium cell *D*. The resistance of this varies with the amount of the reflected light. A telephone receiver *F* is connected in circuit with this cell and a battery, either directly, or through the Brown relay *E* shown in the diagram.

As the line of print is moved slowly across the beam, different notes are heard in the receiver, so that with practice it should be possible to visualize each letter as it passes. In the case of the letter L, for instance, when the upright stem of the letter coincides with the beam, no light would be reflected to the selenium, and the telephone would be almost silent. As the letter gradually passed to the right, all the dots except the lowest would be reflected, and the telephone would emit a composite note consisting of four simple notes corresponding to each of the four dots. When the letter had passed out of range all the five notes would be heard. Once the reader has learned to recognize the various combinations of notes, any kind of type can be read. The lenses are for focussing the beam of light to suit the different sizes of print.

A Novel Indirect Lighting Fixture.

The picture shows a somewhat novel form of indirect lighting fitting, described in a recent article in *The Illuminating Engineer* (London).

The objection is often raised to indirect lighting that the apparent absence of any source of light gives a curious impression of "flatness." Another objection, especially when a single unit is used in the center of the room, is that it appears as a dark mass silhouetted against the ceiling—an effect which is not architecturally desirable.

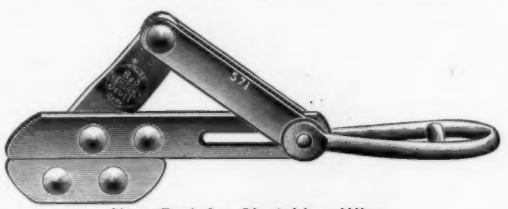
The type of fitting shown below is ingeniously designed to avoid this impression. Tubular lights are arranged round the four sides of a square and

Unique Indirect Fixture.

there is a central space left in the middle through which the ceiling is visible. This helps to relieve the impression of mass and gives a lighter, daintier effect. In this case it was remarked that there was no impression of flatness; on the contrary the lighting, although subdued, was quite cheerful.

A New "Red Devil" Tool for Gripping and Stretching Wires.

A long felt want in the electrical supply trade has been aptly supplied by a very ingenious set of grips for stretching wire,



New Tool for Stretching Wire.

recently brought out by the Smith & Hemenway Company, Incorporated, manufacturer of the well known "Red Devil" brand of hand tools.

This set, which is very complete, includes grips for stretching both smooth and barbed wire, whether of copper or steel. The grips are powerful and compactly made and demonstrate again the careful thought and study that this progressive firm is giving to the many tool problems that daily present themselves.

The illustration given herewith shows the No. 571 grip which will stretch wires from No. 6 to No. 0. This style of grip is made with either pulley or loop. No doubt both the hardware and electrical supply trades will find these grips in popular demand.

Largest Electric Flatiron Order.

An order for 10,500 electric flatirons has been received by the General Electric Company from the United Gas & Electric Corporation for distribution among its various central-station properties. This is said to be the largest order for electric flatirons ever placed. The aggregate amount of flatirons in this order comprises four carloads.

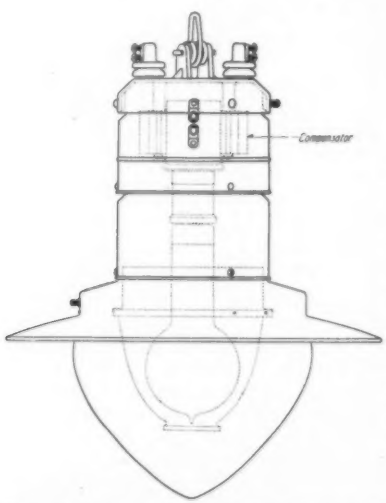
The ever increasing use of electric heating devices is being realized and capitalized by central-station interests to a much larger extent than heretofore. When it is considered that the average income of an electric flatiron is approximately 70 cents a month, the value of this service is self-evident.

New Fixtures for Gas-Filled Tungsten Lamps for Chicago Street Lighting.

Mention has been made in these columns of the placing of an initial order for 2,000 gas-filled half-watt tungsten lamps by the Sanitary District of Chicago for use in the municipal street-lighting system of Chicago. The order calls for not only the lamps but also fixtures in which they are to be mounted. This equipment is now being manufactured and the first batch of lamps and fixtures is now being installed. The results of this installation, which is probably the most important installation of this type of lamp up to the present time, will be watched with great care and, if these results are up to expectations, additional orders to bring the total equipment up to 10,000 lamps of this type will be issued.

The fixture, a general view of which

New Fixture for Half-Watt Mazda Street Lamps.



Main Features of Internal Arrangement of Fixture.

is shown in Fig. 1, was designed by the engineers of the Sanitary District, under the supervision of E. B. Ellicott, electrical engineer. In external appearance it was planned to make the equipment correspond as nearly as possible to the type of fixture now used for flaming-arc lamps, of which over 10,000 are now in use in the city street-lighting service. The lamp selected is rated at 300 watts, 600 candlepower, 20 amperes, and is of the series Westinghouse Mazda type. These lamps will be operated on 10-ampere 60-cycle circuits. Each fixture will contain an autotransformer, or compensator, which will raise the current in the lamp circuit to 20 amperes. This compensator will also have a special tap so that it may be used on a 6.6-ampere circuit, if desired. The compensator is especially designed to protect the lamp from surges in current. It has been found that a 100-per-cent increase in current in the line is deadened to about 40-per-cent current rise in the lamp.

At the top of the fixture is a casting fitted with the usual hanger link used in arc-lamp practice. This casting supports the weight of the compensator, lamp, globes, etc. The body of the casing below this casting is in three parts, of which the lower one is a 24-inch steel reflector with a white fire-enameled reflecting surface. The general features of the internal arrangement are shown in Fig. 2. Directly beneath the compensator is a multiple mogul type socket, which is placed in shunt with the compensator; since the latter is designed to act as a reactance, when the lamp circuit is open, a film cutout type of socket is unnecessary.

Much study was given in the design of the fixture to the matter of ventilation, which is an important requirement for lamps of the gas-filled type. For this purpose a screened annular opening is left between the shade and the outer globe. Through this the air enters, passes through the opening at the bottom of the inner globe and moving upward around the lamp bulb and socket is turned outward by a conically curved deflector plate which surrounds the socket. The air passes out through another screened annular opening between the two cylindrical copper parts of the case; this opening is about in the middle of the housing. The screening at the inlet and outlet openings is to prevent flies and other insects from clogging up the outfit.

It is planned to use two globes in the initial installation. The outer is an opal glass globe of acorn shape similar to those extensively used with the Chicago flame arcs. This globe serves as a diffuser and to reduce the glare from the high-candlepower unit employed. Within this, and shown dotted in Fig. 2, is a cup-shaped prismatic globe of special construction. It is open on top and bottom and is made of two parts, smooth on the outside and provided with prisms between them. These two parts are sealed at the upper and lower edges so that the prisms are hermetically protected from dust and dirt. The object of this inner globe, which is really a refractor, is to distribute the light more evenly over the street surface by raising the candlepower in those angles near the horizontal.

The lamps for this equipment will be furnished by the Westinghouse Lamp Company. The fixtures, including the compensators, etc., will be furnished by the Westinghouse Electric & Manufacturing Company. These companies are prepared to supply similar equipment of other ratings than that given above. This type of fixture has been given the name of Luxsolite by the manufacturers.

Effective Window Display by Cash-Register Concern.

The National Cash Register Company, Limited, the English organization of the great American manufacturing concern, has in a show window of its London headquarters, which occupy the whole of a large building on Tottenham Court Road, an affective display advertisement which aims to impress the value of up-to-date commercial methods. A shallow tank is employed, about four feet wide by six feet long, with outer sides lined with coarse bark to simulate rocks. This tank contains water to the depth of about one and one-half inches, and back of the tank is a painted marine scene in colors, which carries out the effect of a sea coast. Scattered about in the midst of the imitation ocean of real water are rocks which bear the inscription "Temptation," "Mistakes," "Wrong Change," "Carelessness" and "Old Methods." Against these rocks lie the bruised and battered models of wrecked steamers, while in and out among the treacherous reefs plies a little wooden model of a staunch steamer which bears the name "Progress" and carries at its masthead a penant with the company's initials, "N. C. R."

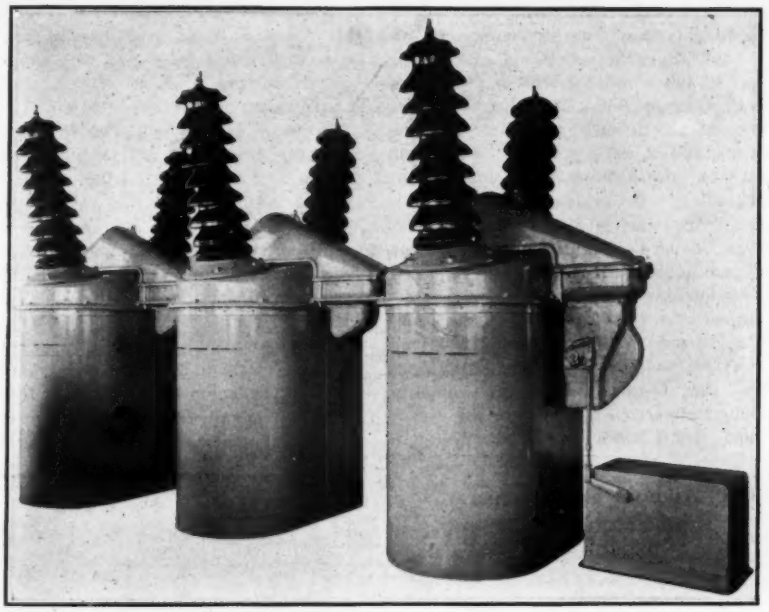
The secret of the safe movements of the little craft, which to the public viewing the display in large numbers, seems little short of marvellous, is an endless chain just underneath the zinc bottom of the tank, which carries a magnet that attracts a magnet carried in the bow of the craft "Progress." The chain is operated by a one-sixth-horsepower motor, which also keeps a splasher in motion just behind the largest and most "forbidding" of the reefs, to agitate the water.

New High-Voltage Outdoor Oil Switches.

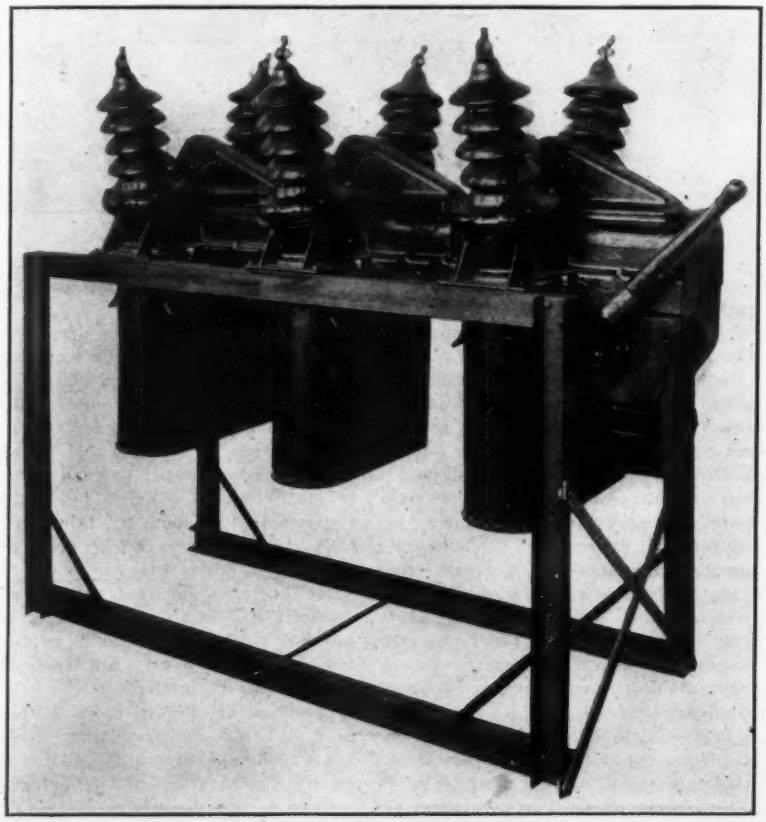
The general principles of operation of indoor and outdoor oil switches are the same, but some of the details of construction are obviously different. In addition to performing the usual duties, the outdoor switch must be so constructed that successful service will result while exposed to the effects of the severest weather. Neither rain, snow, nor sleet should be able to interfere with satisfactory operation. All moving and operating parts must be totally inclosed and fully protected.

A new type of outdoor oil switch, known as the type F, form K-22, has been designed to meet these conditions fully. These switches are built in single-pole elements and are operated by hand, solenoid or air. The mechanism for each element is self-contained and mounted on the top of a steel tank. The switches trip free from the operating mechanism, so that the automatic switches cannot be held closed on overload or short-circuits. All the switches, non-automatic or automatic, are always opened at the same quick rate of speed.

The standard hand operating lever consists of a removable, wooden handle attached directly to the switch mechanism. This handle is removable to guard against unauthorized operation. The solenoid mechanism is similar to the hand mechanism, except that a direct-current solenoid with a rod for connecting to the mechanism is used instead of the operating handle. The air-operated mechanism is rather special.



Solenoid-Operated, 130,000-Volt, 100-Ampere Oil Switch.



Hand-Operated, 22,000-Volt, 300-Ampere Oil Switch.

Since the insulating properties of oil are superior to those of air, the bushings are inserted through the cover at an angle converging at the lower end, which materially reduces the size of the oil tank necessary for any given voltage. The bushings extend below the oil level down to the stationary contacts of the switch. An iron cap forms the top of the bushing. The bushings are supported by metal clamps bolted to the tank cover and may easily be removed for inspection or repair.

The contacts are of the well known "sliding-wedge" construction. Each phase contains two contacts in series. The stationary ones consist of widely flared fingers and extra long arcing tips and drop-forged copper. The movable element of the contact is a wedge-shaped copper blade. This blade moves in a vertical plane, being drawn up by the switch mechanism when the switch is closed and dropped by gravity, assisted by springs, when the switch opens. As the wedge-shaped movable contact enters the stationary flared contact, a steady and increasing pressure is exerted on the contact surfaces, which insures good contact, especially since the contact surfaces are kept clean and bright by a rubbing motion each time the switch operates. By the use of the sliding-wedge contact, the arcing set up by opening the switch under load occurs between the extended portion of the stationary contact fingers and the upper extremity of the movable blade, which sections are not in contact when the switch is fully closed.

The switches are, as a rule, tripped on overload by trip coils acting directly

on the switch toggle and operated by bushing-type current transformers, although the other methods of tripping oil switches in general use can, of course, be applied. These transformers consist of the switch stud as the primary and a copper ribbon wound on an iron core around the bushing as the secondary. From one to six transformers with from one to three trip coils may be used on a three-phase circuit, depending on the protection required. The bushing transformer has been designed to furnish at a low cost a series transformer for high-tension systems.

These switches have been developed by the General Electric Company, Schenectady, N. Y., and are for use on lines from 22,000 volts upward.

The Audion as a Generator of High-Frequency Currents.

As a fitting climax to his years of development of the Audion as a wireless detector, amplifier and oscillator, Lee de Forest has recently publicly disclosed apparatus for generating in an incandescent lamp continuous high-frequency oscillations from a direct-current source to be used as a transmitter for wireless telephony and telegraphy, as well as for numerous laboratory applications. Such a simple and ideally constant means for producing undamped wave energy of practically any wave-length, as readily as turning on an incandescent lamp, has been generally regarded as a chimera, too far in the future for practical consideration.

There is therefore unusual interest in the announcement that Dr. de Forest is now actually putting upon the market an oscillating Audion (in certain forms called by him the "Ultraudion"), which when connected to a 110 or 250-volt lighting circuit becomes a generator of oscillations of a surprising degree of efficiency.

The small-sized 3.5-volt amplifier bulb when properly excited, can generate alternating currents at frequencies from 60 to 1,000,000 per second representing as much as a few hundredths watts energy, while with larger bulbs for 110 or 250-volt current two or three watts of high-frequency energy can be generated with no special external source of power, or at most with only two or three hundred volts from a small source, such as small dry cells.

With this form of transmitter and an ordinary solid-back or Berliner microphone, it is possible to telephone wirelessly for one to three miles using an Audion as the receiving detector.

As a small, portable, easily applicable wireless telephone, this new Ultraudion oscillator should fill a long-felt want, as it will now be possible for anyone who has the customary direct-current lighting supply and a respectable sized antenna, to plug in to a lamp socket and telephone to a neighbor or across a river, from small yachts, tugs and ferryboats, etc.

The new system is found to be remarkably constant and reliable in operation and so simple, being perfectly free of adjustments, that where the operator is content to stay on one established wave-length and not seek to switch around on various tunes, the veriest tyro can operate the set.

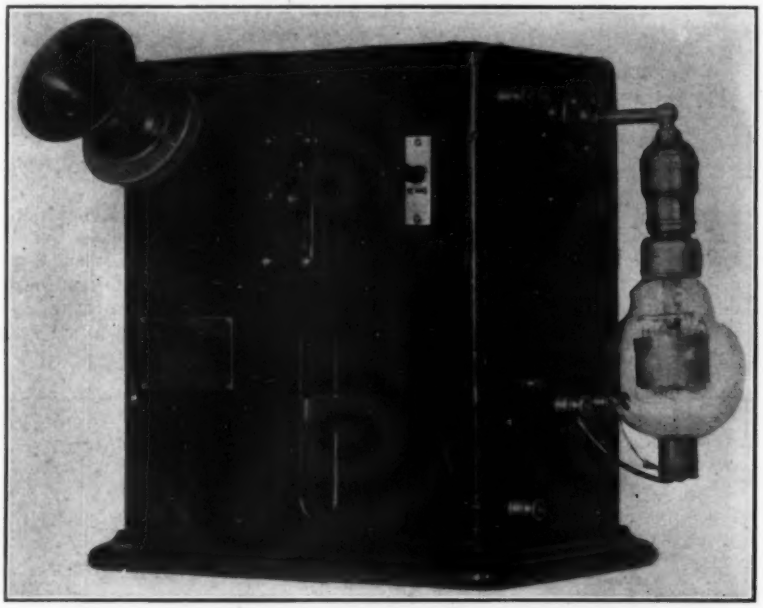
Where storage-battery supply is available, the oscillating Audion transmitter, being perfectly quiet, can serve equally well as the receiving Audion, both functions of transmitting and receiving being then performed by the same bulb, a telephone receiver being kept connected in the wing-filament circuit the same as in the ordinary receiving Audion.

In this case the same tuning circuits serve for transmitter and receiver. Then, if both stations are using the same wave-length, the necessity for throwing over from talking to listening is avoided, and it is possible to talk both ways as over a line.

Unlike all arc or high-frequency alternator generators the de Forest oscillator is absolutely noiseless in the receiver, so that one hears nothing whatever except the voice. The latter possesses a clearness and crispness unlike anything heard in other forms of wireless telephone.

Where storage-battery supply is not available, the receiving instrument includes a small Audion exactly as in other forms of de Forest wireless receivers, and a small switch or push button is utilized for throwing from talking to listening in the simpler sets. In the more elaborate ones, however, Dr. deForest has worked out a balanced circuit by means of which the receiver circuit is uninfluenced by the energy of the home transmitter, while receptive to that from the distant talking station, provided a difference of five or more per cent in wave-length be used. Duplex wireless telephony was never possible with any form of arc on account of continual disturbances and irregularities.

While the new transmitter is as yet of small power, there appears no definite limit to the size or amount of energy which can be transformed from direct or low-frequency current to high or radio frequencies by means of the Audion generator.



High-Frequency Generator for Radiotelephony and Radiotelegraphy.

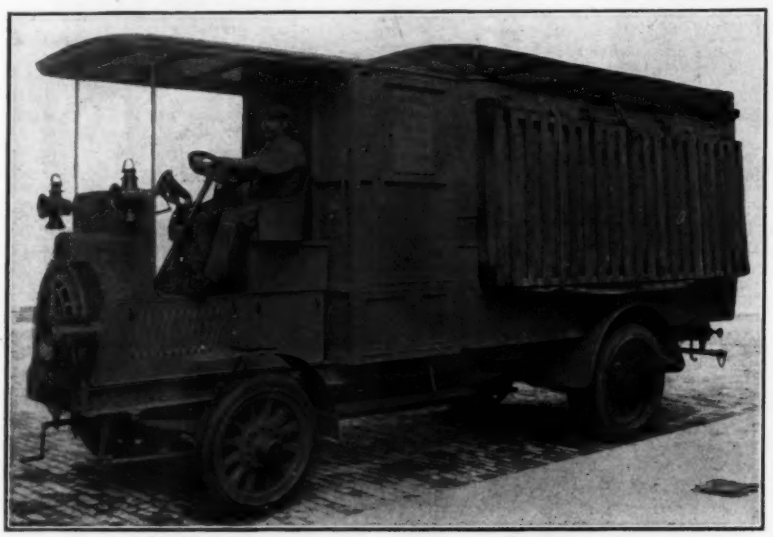
Dr. de Forest has under preparation one now intended for handling one kilowatt in which the grid and plate members are oil-cooled, the tungsten glower or filament being designed to carry five amperes. A "B" potential of 1,000 volts, supplied from a small motor-generator set is included, but his investigations lead him to believe that lower "B" voltages can be used with even larger power than the above.

He sees no inherent reason why Audions delivering 10 kilowatts and possibly 50 or 75 kilowatts of high-frequency energy may not some day be built for radiotelephony.

Complete de Forest radio telephone sets utilizing the oscillating Audion are already manufactured and for sale by the Radio Telephone & Telegraph Company, 309 Broadway, New York City.

Ozone Car for Sterilizing Water for Military Use.

The new Schneider automobile outfit developed in France is sure to be of great service in the numerous cases where sterilized water is needed in large quantities, and it is designed mainly with a view of using it in the colonies or on the battlefield. In some colonial regions the water supply is far from pure, and in the case of expeditions or various enterprises the personnel is exposed to great danger from diseases due to impure water. This is especially true in time of war in the colonies, and even in some regions of France, and it often happens that the troops have to boil their water in cases where disease germs prevail. The new automobile provides a ready means of securing a good water supply by the use of sterilizing apparatus.



Portable Outfit for Sterilizing Water by Means of Ozone.

A roomy automobile of the power van type carries the whole plant so that it can be run to wherever it is needed and is ready for work at a moment's notice. The scheme of the equipment is to take in water on one side from any source, such as spring, river or well, and after passing through the filters and sterilizers, the water is delivered at the other side of the car into a treated canvas tank. In the illustration this latter will be noticed folded against the side of the car for convenience in transportation.

A 40-horsepower engine runs the automobile as well as a good sized dynamo, which is mounted on the inside of the car. The electric current goes to an ozone generator of the Otto type, which produces the ozone in the well known way by means of a high-tension discharge between sets of metal plates, a current of air being sent through the ozonizer so that it comes out charged with ozone. This air is then sent into the mixing tank which holds the water, and by the use of a special device the air is intimately mixed with the water in the form of emulsion so that the ozone destroys all the microbes. This method has the advantage over the ultra-violet ray method in working at a much higher rate of flow and thus giving a large output, such as the present system requires. Inside the car is a large water-holder of prepared canvas, which receives the water that an electric motor-driven pump takes up from the outside source. Here the water is allowed to settle and deposit the heavier impurities, then it goes through a set of rapid filters which make use of multiple disks of compressed cotton. From the filters it passes into the ozonizing device and is sterilized. Then it is delivered from the wagon into the outside tank. The troops thus have a good supply of water for drinking or cooking purposes.

Wireless Control for Fog Gun.

The Marconi Wireless Telegraph Company has completed experiments in controlling safety signals of various kinds from a distance by means of radiotelegraphy. Two fog guns equipped with this system of control have been in operation by the Clyde Lighthouse Trust in England. The function of the wireless control is to enable the coast guard station to turn the gun on or off as desired, according to the condition of the weather.

The apparatus is applied to a Stevenson-Moyes acetylene gun. It contains a gas-admission valve introduced between the gas generator and the gun itself. This needle valve is controlled by two electromagnets, so arranged that when the first magnet is energized the valve opens wide and allows the gas to pass freely. When the second magnet is energized the valve shuts firmly against a pressure of 20 pounds a square inch—a pressure considerably in excess of the maximum used in the acetylene gun.

Next to the valve is a water-tight metal box containing the wireless receiving gear. Connection to the receiving aerial is made through an insulator; the received signals pass through the receiving apparatus to earth. A special form of detector is used which actuates a special relay which is so constructed that, although very sensitive, it has a large movement and is therefore capable of keeping in adjustment under all kinds of temperature conditions. This end is further assured by the provision of counterbalancing springs.

Two synchronizers are an essential part of the apparatus, and make it immune from the two great troubles of wireless—atmospherics and interference from powerful signals from passing ships. It enables the same apparatus to perform two distinct functions—to turn "on" and "off" the gun. One of these synchronizers is connected to one of the two electromagnets of the gas valve, so that when one synchronizer is actuated by the relay, it energizes one magnet and opens the valve, which remains fully open until the second synchronizer, actuated by the same relay, energizes the second magnet and closes the valve.

The second synchronizer is also in an air-tight case containing a clockwork mechanism which runs for four months with one winding. This clockwork performs a useful function every ten minutes; it strikes a sharp blow with a hammer, which gives the relay contacts a shake, gets rid of any stickiness, either in the pivots or at the contacts themselves, which might develop after several months, and at the same time causes a momentary current to flow through the detector.

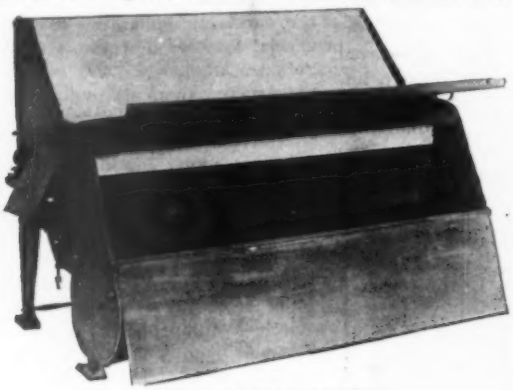
A battery of dry cells provides the driving power for the whole receiving apparatus. A small aerial, supported from a short mast about 14 feet high, completes the receiving apparatus.

The transmitting apparatus, installed on shore and in charge of the coast guards, is very simple. For short distances, such as four-mile communication, it consists of a small transformer, a transmitting jigger and condenser, and the transmitting synchronizer corresponding to those of the receiving set. For greater distances the same apparatus will serve if a greater aerial height is available; failing this, a dynamo is used to provide the additional power.

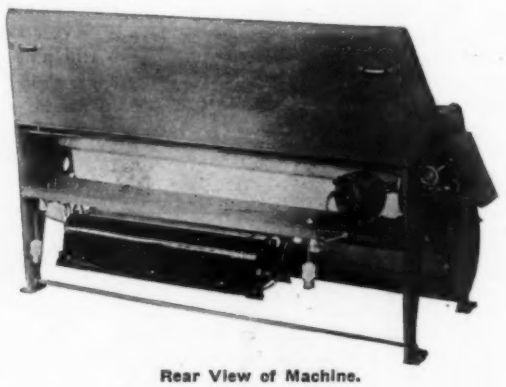
A Compact and Efficient Blue-Printing Machine.

Wickes Brothers of Saginaw, Mich., have just placed on the market a blue-printing machine that makes prints of width from two inches to 48 inches and of any length, and occupies a floor space of only 2.5 by 5 feet.

This machine has a number of interesting and convenient features. Either separate or continuous prints can be made as desired. The work can be carried out in a lighted room as both the unprinted paper and the finished prints are kept in lightproof compartments. The operator performs all operations from the front of the machine and controls the light and the speed of the machine from the same point. Tracings, when printed, can be delivered either to him or into the compartment in the rear.



Front of Blue-Printing Machine.



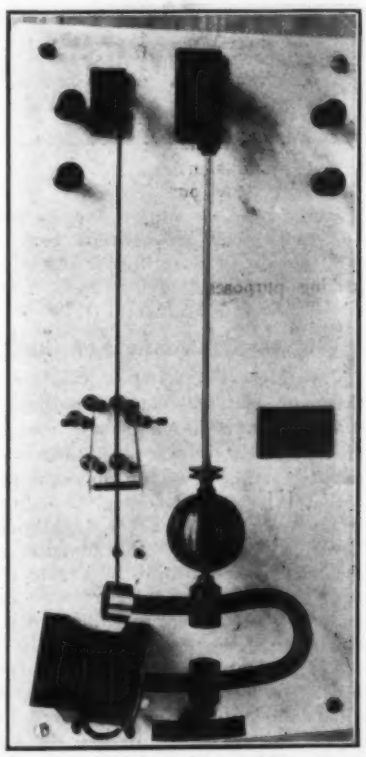
Rear View of Machine.

The tracings and paper are fed into the machine on an endless, automatically tightened belt, which is operated by a Westinghouse electric small motor. They then pass around the printing cylinder, which consists of spirally disposed bronze wires, so arranged that the paper and tracings are kept perfectly smooth while passing around. Inside the cylinder is a Cooper Hewitt mercury-vapor lamp, which has been found to be a very desirable source of light for blue-printing, as it is rich in rays with actinic powers particularly adapted for this work. The manufacturers claim that this wire cylinder offers less obstruction to the light than a cylinder of glass, produces prints of a uniform tone, and is in addition self-cleaning and practically indestructible. From the cylinder the tracings and paper pass into the convenient storage compartment.

Since a current of only five amperes at 110 volts is needed for the small motor and the mercury-vapor lamp, the expense of operation is very small, the manufacturers claiming that the cost does not exceed one-quarter cent per square foot of blue-print paper.

Frictionless Contact-Maker for Electric Clock Pendulum.

Electric clocks have quite a number of advantages over ordinary clocks, and they are largely used for very accurate time indication, where it is of importance that there should be scarcely any variation in the time during quite a long period. But even in the electric clock there is one drawback which seriously interferes with keeping exact time and that is in the mechanical contact which needs to be made each time the pendulum swings, so as to make and break the electric current. Even this small amount of friction will prevent the clock from running correctly, for even the smallest fraction of a second at each beat of the pendulum will amount to a considerable value in the course of several days.



Frictionless Contact for Pendulum.

A French scientist, Charles Féry, secures much more accurate running of the clock by making a contact which has no direct connection with the pendulum. On the bottom of the pendulum is a double magnet consisting of an upper and lower branch. The bottom solenoid attracts the lower branch into it and releases it again, according to the electric contacts which are made and broken above. But the pendulum does not make these contacts in the usual way by direct movement, for the upper branch of the magnet enters a small metal ring without touching it, and the magnetic reaction due to induction between magnet and ring causes the ring to be moved by the magnet even though a direct contact does not take place. The ring is mounted on the end of a long swinging rod, and contacts are made with two spring blades, as will be noticed. Mr. Féry thus makes an ingenious solution of the problem of making electric contacts without any direct action of the pendulum.

A Correction.

In the issue of June 27 an article was published on page 1305 entitled "Two Interesting Motor Installations," in which a description was given of a motor-driven stoker in the plant of the Austin Manufacturing Company.

The motor in question is equipped with a starter of the graphite compression type made by the Allen-Bradley Company, of Milwaukee, Wis. This rheostat was incorrectly stated to be the product of another manufacturer.

The Postmaster General of Australia hopes to be able to install at busy street corners in Sydney, New South Wales, and other large Australian cities, a combination pillar mail box, telephone cabinet, and stamp-selling machine. A new style of telephone booth will be tried; ventilation and privacy will be combined.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

ATTACHMENT PLUGS, Fuseless. —Diehl Manufacturing Company, Elizabethport, N. J.

"Diehl," 10-ampere, 250-volt, separable, pin-type, attachment plug, adapted for use on sewing-machine equipment. (See cut.)

Approved May 29, 1914.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

Couplings, connectors and armored cable, catalog Nos. 2221-22, 2224-26, inclusive.

Approved June 15, 1914.

ELECTRICALLY LIGHTED SCALE.—Angledile Computing Scale Company, Elkhardt, Ind.

A computing scale provided with an attachment plug and cord, and five small incandescent lamps which illuminate the dial, drum and display sign when material is placed on the scale to be weighed.

Approved June 15, 1914.

FLEXIBLE CORD.—B. F. Goodrich Company (Diamond Division), Akron, O.

Marking: Two red threads and one black thread cabled with copper strands.

Cords shown by test and examination conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, have labels attached.

Approved June 15, 1914.

FLEXIBLE CORD, Portable Armored.—Penn Yan Cable Company, Penn Yan, N. Y.

Armored flexible cord having two strips of galvanized steel armor over pendent flexible cord.

Armored flexible cord shown by tests and examination conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, has label attached.

Approved May 23, 1914.

FIXTURE WIRE.—Canadian General Electric Company, Limited, 212 King Street, Toronto, Canada.

Marking: One red and one black thread crossing in the braid.

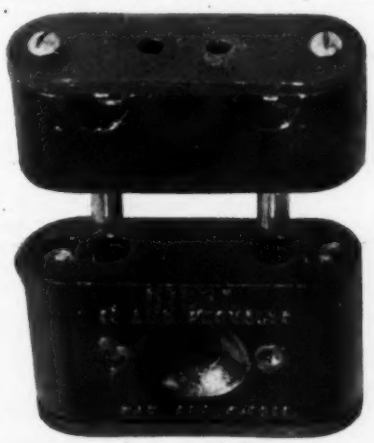
Fixture wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached.

Approved June 4, 1914.

OZONATORS FOR AIR.—Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York, N. Y.

For alternating-current circuits, 125 and 250 volts, 25 to 60 cycles: type A-1, with motor and blower.

This device consists of an air-cooled, high-tension transformer and a number of condensers, all inclosed in a metal or asbestos-lined wooden cabinet and mounted on a slate slab which forms either the base or the top. Each



Attachment Plug for Sewing Machines.—Diehl Manufacturing Company.

ozonator is provided with a controlling switch, fusible cutout and suitable terminal connection for portable flexible cord. A blower direct-connected to a motor or rotary converter is also furnished. The full input is less than 250 watts. For use on ordinary lighting circuits.

Approved June 4, 1914.

MOLDING FITTINGS. — Crouse-Hinds Company, Syracuse, N. Y.

"Condulet" molding fittings.

For molding work only, type M.

For combination conduit and molding work, type O.

Metal and porcelain covers for above condulets.

Approved June 15, 1914.

RECEPTACLES, Standard.—Connecticut Electric Manufacturing Company, Bridgeport, Conn.

"C. E. M. Co." 660-watt, 250-volt.

Sign or conduit box, catalog No. 9001.

Approved June 15, 1914.

RECEPTACLES, Standard.—Chapman & Walker, Limited, submitters. Manufactured by Sterling Telephone & Electric Company, Limited, London, England.

Brass shell.

Pull, 250 watts, 250 volts, catalog No. A-614.

Approved June 10, 1914.

RECEPTACLES, Standard.—Federal Electric Company, manufacturer for Federal Sign System (Electric), sole agents, Lake and Desplaines Streets, Chicago, Ill.

"Federal."

Sign, catalog No. 325.

Outlet box, catalog No. 304.

Approved June 15, 1914.

RECEPTACLES, Standard.—The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

Pilot lamp receptacle, 75 watts, 125 volts, catalog No. 2,999; consists of a special porcelain base, candelabra lamps and face plate with bull's eye.

Approved June 2, 1914.

RECEPTACLES, Weatherproof.—Connecticut Electric Manufacturing Company, Bridgeport, Conn.

C. E. M., 660 watts, 250 volts.

For conduit boxes, catalog No. 9008.

Approved June 15, 1914.

ROSETTES, Fuseless. — Crouse-Hinds Company, Syracuse, N. Y.

Three amperes, 250 volts.

Condulet type catalog Nos. CC339, RK532, RK538 RK539, JC1, JC2, JC3, JF1, JF2, JF3, JF19, JF29, JF39, C442, C448 and C449.

Conduit box type, catalog No. C339.

Molding type, catalog Nos. A332, A338 and A339.

Cleat type, catalog Nos. B332, B338 and B339.

Approved June 15, 1914.

SOCKETS, Standard.—H. T. Paiste Company, Thirty-second and Arch Streets, Philadelphia, Pa.

"Paiste" brass-shell sockets.

Key, 250 watts, 250 volts, catalog Nos. 5418, 5500-02 inclusive, 5518, 5524, 9386, 43389, 50760, 59480-81, 59484, 59486, 99392.

Keyless, 660 watts, 250 volts, catalog Nos. 5419, 5503-05 inclusive, 5519, 5525, 9392, 43390, 50768, 59482-83, 59485, 59487, 99392.

Pull, 250 watts, 250 volts, catalog Nos. 5400-01, 5420, 5427-28, 5530-32, inclusive, 5539, 5542.

Also the above types with shadeholders attached.

Approved June 9, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company will extend the electric lighting to Shelburne Center. A 2,300-volt line will be run from the poles of the main line from Gardener Falls to Greenfield.

WAYLAND, N. Y.—The Wayland Electric Light & Power Company will construct about three miles of transmission lines in Wayland. John Kimmell is manager.

SOUTH ATLANTIC STATES.

CLARKSBURG, W. VA.—The Clarksburg Gas & Electric Company is having plans prepared by S. B. Martin, Pittsburgh, Pa., for a power plant to be established here to cost $100,000.

SCOTLAND NECK, N. C.—July 23 bids will be received for equipment for enlarging the electric light plant here. Address William M. Piatt, engineer.

LAKE CITY, S. C.—The J. B. McCrary Company, Third National Bank Building, Atlanta, Ga., has prepared plans for the construction of a complete modern electric lighting plant to be installed here at a cost of $12,000. The plant consists of a 75-kilovolt-ampere generator; 100-horsepower engine, 112-horsepower pole line.

CHATSWORTH, GA.—The J. B. McCrary Company, of Atlanta, Ga., has prepared plans for an electric lighting system to be established here. Address the city clerk.

VALDOSTA, GA.—The City is planning to establish an electric light system costing about $10,000. Address W. D. Peeples for further information.

DETROIT, FLA.—A company has been organized with a capital stock of $25,000 by M. G. Tarcey, of Miami, J. M. Powers, and others to establish an electric light plant here.

HAWTHORN, FLA.—An electric-light system will be established here. Address the city clerk.

NORTH CENTRAL STATES.

BLUFFTON, O.—Twenty thousand dollars will be spent here in improvements on the municipally owned electric light and water works in the near future. H.

MIDDLETOWN, O.—Power and transmission equipment will be required in the construction of an electric line proposed by the United Brethren Church, near here, to connect Cincinnati and Dayton. The church owns a 4,000-acre farm, and desires direct communication with the two cities to facilitate marketing its goods. L.

URBANA, O.—The Urbana Light Company will extend its lines from a point three miles from Catawba to that place, to furnish current for all purposes, if its proposition to the Catawba Council to that end is accepted. If not, an election will be held in Catawba on July 21 to vote on a bond issue to provide for bringing current from Vienna, O., to Catawba. L.

SPRINGFIELD, ILL.—The building of a big electric plant on the outskirts of Springfield which will furnish power for adjoining Illinois cities is being considered by eastern capitalists according to F. E. McCarthy, of New York City, who states those interested have under consideration the purchase of enough mines in the county to furnish an output of 10,000 tons of coal daily. This coal would be used in the generation of cheap electricity, which would be sold in wholesale quantities to different cities of central Illinois.

SULLIVAN, ILL.—This city proposes to spend $15,000 making improvements on its municipal light plant and $20,000 for improvements at the water works and extension of mains. The proposition of a $35,000 bond issue to cover these improvements will be voted on by the citizens on July 28. Z.

DETROIT, MICH.—The Eastern Michigan Edison Company, with division headquarters in Ann Arbor and Mt. Clemens, has applied to the State Railroad Commission for permission to issue $535,000 in bonds. The money will be expended upon general improvements and general extensions, according to Samuel C. Mumford, secretary of the company.

MUNISING, MICH.—The Electric Light & Power Company, will erect a modern electric light plant here. Three 150-horsepower boilers; one 250-kilowatt three-phase generator, one 100-kilowatt three-phase generator and vacuum pumps will be purchased.

FOND DU LAC, WIS.—The Eastern Wisconsin Railway & Light Company contemplates the extension of its line into the eastern and Western sections of the city. Address J. P. Pulliam of Oshkosh, manager.

VIROQUA, WIS.—Edwin M. Tainter will superintend the installation of an electric light plant here. C.

COTTONWOOD, MINN.—Bert Cleland and Elfie Hanson, of Iroquois, S. D., have secured a franchise to install an electric-light plant here.

SLAYTON, MINN.—Victor Klinger has been granted a 25-year franchise to establish an electric-light plant here.

WINONA, MINN.—The Wisconsin & Minnesota Power Company has been organized here with a capital stock of $10,000. John J. Brewster is president and Blaine Gavette, secretary.

DES MOINES, IOWA.—The Des Moines Electric Company will start work immediately upon the big improvements to its present power plant on the river front costing $160,000.

MALVERN, IOWA.—The Malvern Light & Power Company has been incorporated to erect and maintain poles, wires etc.

KAHOKA, MO.—$11,000 in bonds has been voted for the erection of an electric light plant here. Address H. W. Trump, city clerk.

CLARENCE, MO.—$10,000 will be expended improving the electric light system here. Address the mayor.

MEADVILLE, MO.—An election will be held shortly to vote bonds for an electric light plant. M.

NEVADA, MO.—The city is planning to construct an electric light system here. Address the city clerk.

PALMYRA, MO.—$32,000 will be spent by the City Council on improvements in the electric light and water plant as the result of a special election held on July 7. M.

PATTONSBURG, MO.—O. L. Wright and G. E. Weaver have been granted a franchise to construct an electric light plant at Pattonsburg. M.

ST. LOUIS, MO.—The Franklin Avenue Improvement Association has completed its arrangement for properly lighting Franklin Avenue from Fourth to High Streets. Address Herman Mauch, president.

GRAND FORKS, N. D.—The city will lay about 4,000 feet of underground conduit, and extend the ornamental street lighting system. Address J. J. Smith, city engineer, for particulars.

ALEXANDRIA, S. D.—On August 1 bids will be received for the construction of the municipal electric light system. Address H. M. Schumacher, city auditor.

ST. PAUL, NEB.—The City Council is considering plans for the construction of a municipal light plant here. Address the city clerk.

HORTON, KANS.—About $7,000 will be spent for improvements to the municipal light plant. A new 400-horsepower engine and generator will be bought. A transmission line probably will be built from Horton to Powhattan, which recently voted $10,000 for lights. Address Superintendent Wood, of Horton. M.

KANSAS CITY, KANS.—A special election has been called for August 25 to vote on a bond issue of $200,000 for improvements to the municipal electric-light plant, as well as an issue of $450,000 for extensions to the water works. George Little is city clerk. M.

LEAVENWORTH, KANS.—W. J. Squires has applied to the City Council for a franchise to construct and operate an electric light plant at Leavenworth.

MINERAL, KANS.—The Empire District Electric Light Company, of Joplin, Mo., probably will construct a transmission line from its substation at Scammon to Mineral, and will provide power for mines to be opened. M.

TOPEKA, KANS.—The electrical equipment in the auditorium has been condemned and will be replaced. E. J. Stewart is electrical inspector. M.

WESTPHALIA, KANS.—The city has signed a contract with local business men, and the latter will install an electric light plant at once. M.

SOUTH CENTRAL STATES.

LOUISVILLE, KY.—The Louisville Board of Education has included courses in electric wiring in its pre-vocational school and will equip an annex to the administration building at Eighth and Chestnut Streets for that sort of training for boys, as well as to accommodate other classes in printing, bookbinding and commercial sewing for both boys and girls. G.

OLIVE HILL, KY.—The Tygart Electric Company has been incorporated with a capital stock of $8,000, to establish an electric light plant here.

WINGO, KY.—Five votes defeated the proposal here that the corporation issue $10,000 in bonds to install and operate an electric light and water plant. It is possible that the utilities may be organized by private enterprise. G.

GURLEY, ALA.—The Gurley Light & Power Company will rebuild its plant recently destroyed by fire. One 40-horsepower engine, 60-horsepower generator, 50-horsepower boiler and 50-horsepower oil engine will be installed.

LEEDS, ALA.—The Leeds Light & Power Company will be incorporated with a capital stock of $3,000 to operate an electric light and power plant here. Address Thomas W. Martin, of Birmingham.

CISCO, TEX.—The Cisco Gas & Electric Company, which has been organized here with a capital stock of $50,000, will construct an electric light and power plant at Cisco. The incorporators are W. S. Michael, W. H. Tebbs and G. G. Ward. D.

GALVESTON, TEX.—Franchises giving the right to construct, operate and maintain street railways, light and power lines, waterworks and sewer systems in those suburbs of Texas City known as Texas City Heights and subdivisions Nos. 5 and 6, have been granted to the Texas City Street Railway Company, the Texas City Electric Light & Power Company and the Texas City Sewerage Company. The franchises are extensions of rights granted to the same companies to operate within the corporate limits of Texas City and will provide for the growth of that municipality for a number of years. Construction of a portion of the proposed improvements probably will be started within a short time, while other extensions will be made as rapidly as the growth of the suburbs warrant.

GORMAN, TEX.—Plans are being prepared by the DeLeon Gorman Light & Power Company for the construction of a power plant at Gorman.

WESTERN STATES.

THOMPSON FALLS, MONT.—The Interstate Power Company was recently organized and incorporated with a capitalization of $450,000, by Edward Donlin, I. E. Keith, and Andrew Peterson, all of this city, which is given as principal place of business. It is assumed that the Montana Power Company is back of the company, which purposes acquiring and developing various water-power sites between this city and the Montana-Idaho interstate line, on the Clark's Fork of the Columbia River. It is reported that a crew of engineers is now engaged in making the preliminary surveys where three power plants are to be built. One will be constructed near Belknap, one near the town of Trout Creek, and one at or near Cabinet Gorge. O.

JEROME, ARIZ.—The Upper Verde Public Utilities Company has been granted a franchise for an electric light and power system in this city.

KALAMA, WASH.—This city contemplates the construction of a semi-municipal electric light and power plant, by purchasing power from some company other than the Washington-Oregon Corporation, and by constructing a city-owned distributing plant. Alleged unsatisfactory service on the part of Washington-Oregon Corporation, and the intention of the Mountain Timber Company to electrify its large lumber mill, and proposed wood-working plant, are the reasons for bringing up the issue. O.

RIDGEFIELD, WASH.—J. H. Cunningham, Portland, Ore., has been granted franchises for establishing an electric-light plant at this place.

SPOKANE, WASH.—The Washington Water Power Company recently informed Commissioner of Public Utilities C. M. Fassett that if the company is given a renewal of its lighting contract on a 10 to 15-year basis, it will overhaul all its present arc lamps in the residence districts, and install the modern luminous street arc, such as used in the business section of the city. To install the new system will require a considerable investment. O.

GLENDALE, ORE.—The Oregon-California Electric Company contemplates extending its power line from Glendale to Riddle, and surrounding territory, a distance of about 20 miles. O.

PORTLAND, ORE.—The Pacific Telephone & Telegraph Company will immediately begin the construction of three new toll lines between this city and Astoria, which will double its present wire facilities. The improvement will cost in excess of $20,000. O.

SALEM, ORE.—State Engineer Lewis has approved of the application of George W. Holcomb, of Portland, to appropriate 1,500 feet of water per second on the Clackamas River, to be used for the development of 10,225 horsepower. The estimated cost of a plant to be built is $1,000,000. It is thought this promoter represents the Portland Railway Light & Power Company, of Portland, as this company has been granted a permit recently to construct reservoirs on the headwaters of the Clackamas. Two dams, one 30 feet high, and one 80 feet high, will be built by this company. O.

TILLAMOOK, ORE.—F. D. Small and D. C. Urie have been granted a franchise to construct and operate an electric light plant in Tillamook to cost $30.000.

WHEELER, ORE.—The city is preparing to install a municipal lighting system.

PORTOLA, CAL.—The Railroad Commission has granted R. B. Young a certificate of public necessity and convenience to operate an electric plant in and about this town.

PROPOSALS.

INCANDESCENT LAMPS.—The Board of Public Works, Seattle, Wash., will receive bids until July 24 for furnishing the Lighting Department with 415,500 incandescent lamps. O.

TURBINE-DRIVEN EXCITER.—On July 25, bids will be received for furnishing and installing one 40-kilowatt turbine-driven exciter in the central power plant at the Navy Yard, Puget Sound, Wash. Address H. R. Stanford, Chief of Bureau.

BALANCER SET.—Sealed proposals will be received at the Engineer Depot, Washington Barracks, D. C., until August 4 for furnishing one balancer set, with option to order two additional sets. For further information apply to Joseph E. Kuhn, Lieutenant Colonel of Engineers.

CABLE.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until July 22 for furnishing under Proposal 707, 5,000 feet of cable, type 649. Further information may be obtained from Charles S. Wallace, Captain, Signal Corps, U. S. Army.

MOTOR-DRIVEN PUMP.—Sealed proposals will be received at the office of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 28 for furnishing one motor-driven vacuum pump, complete, and a control panel for same, as per Schedule 7011, for delivery at the Navy Yard, Norfolk, Va.

SWITCHBOARD.—Bids will be received by the town of Wabasha, Minn., for one metal-covered integrating watt-meter switchboard; one graphic-recording watt-meter switchboard; one set current and potential transformers for operating above meters, 50 horsepower, 2,200 volts, 60 cycles, three phase motor-sloping type; complete for installation.

ELECTRICAL EQUIPMENT.—Major J. B. Cavanaugh, Burke Building, Seattle, Wash., will receive bids until August 10 for the installation of electrical equipment and operating machinery in the locks of the Lake Washington Canal, same to cost approximately $150,000. The War Department, Washington, D. C., recently rejected the first bids submitted. O.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received at the office of the General Purchasing Officer, the Panama Canal, Washington, D. C., until August 5 for furnishing material, under Panama Circular 861, for two 44,000-volt substations at Darien and Gamboa, including transformers, switches, lightning arresters, switch panels, annunciators, fittings, etc. Blanks and general information may be obtained from any of the Assistant Purchasing Officers, who are located in all of the large cities of the United States.

ELECTRIC-LIGHT PLANT.—The Village of Greenup, Ill. will receive bids on July 20 for a new electric light plant of 75-kilowatts capacity. Specifications call for a high-speed steam engine for direct connection to generator. Alternate bids will also be received for Corliss type engine and belter generator. Bids will also be received for a 250-gallon-per-minute motor-driven triplex pump for pumping plant. Plans may be seen in the office of the village clerk, Greenup, or in the office of the engineers, Fuller-Coult Company, St. Louis, Mo.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until August 4 for furnishing the interior lighting fixtures of a two-story building for the post office at Wytheville, Va.; and until August 12 for the same for a two-story building for the post office at Georgetown, Ky., and until August 14 for the same for a two-story building for the United State appraisers' stores at Milwaukee, Wis. Drawings and specifications may be obtained from the office of the Supervising Architect or the custodians of the sites named.

FOREIGN TRADE OPPORTUNITY.

[Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., and at the branch offices of the Bureau, 315 Customhouse, New York, N. Y., 629 Federal Building, Chicago, Ill., Association of Commerce Building, New Orleans, La., and 310 Customhouse, San Francisco, Cal. Apply for addresses in letter form, giving file numbers.]

NO. 13,311. CLOTHES CLEANERS, ELECTRICAL APPLIANCES AND NOVELTIES.—An American consul reports that the manager of an electric plant in the Far East desires quotations on clothes cleaners, to be used with either 200 or 210 volts direct current. He would also be interested in any electric appliances and novelties. Correspondence should be in English.

FINANCIAL NOTES.

The Cities Service Company has certified an increase in its capital stock from $50,000,000 to $65,000,000, of which $10,000,000 will be in the preferred stock to $40,000,000 and $5,000,000 in the common stock to $25,000,000. Stockholders approved the plan at a meeting held on April 7 at Dover, Del.

The $500,000 three-year six-per-cent notes of the Lincoln Gas & Electric Light Company, maturing August 1, will be paid from the proceeds of $500,000 six-per-cent three-year notes, dated July 1, 1914, and sold through A. B. Leach & Company, New York City. The collateral for the new notes is the same as that held against the maturing issue.

Stockholders of the United States Light & Heating Company have received circulars from C. A. Starbuck, chairman of the board of directors, offering $1,000,000 of the company's $1,500,000 first-mortgage serial six-per-cent bonds which were authorized at the stockholders' meeting in April. The bonds are offered on a 6.75 per cent basis, with prices ranging from 98 for the 1917 maturities to 93 for the 1929 maturities, with accrued interest from May 1.

Plans are now being made by the Federal Light & Traction Company for extensions and betterments to plants of its various subsidiaries calling for an expenditure of $415,000. Of this amount $110,000 will be expended at Trinidad, Colo., to furnish facilities for supplying power to the St. Louis, Rocky Mountain & Pacific Coal Company and $20,000 for street lighting. At Tucson, Ariz., $170,000 will be used for powerhouse and gas extensions, traction company improvements, etc., and $15,000 at Albuquerque, N. M. The remaining $100,000 will be spent for track improvements for the Springfield (Mo.) Traction Company.

The Coon Rapids hydroelectric power plant, now under construction with initial development of 10,500 horsepower, owned by the Northern States Power Company, through its subsidiary corporation, will be completed about August 1. For this construction there has been authorized $2,500,000 Northern Mississippi River Power Company five-per-cent bonds, due 1938.

The Railroad Commission of California has approved the Pacific Gas & Electric Company's plan of financing as outlined in a recent letter to stockholders. At the offices of the company it is explained that there is no present intention of selling the $5,000,000 of general and refunding bonds now pledged under its notes, as the proceeds of the $12,500,000 of first preferred stock will enable the company to pay all its outstanding notes and to meet all of its construction requirements during this and next year, and that the proceeds of the $5,000,000 of refunding bonds, when sold, will be a part of its working capital. Vice-president Hockenbeamer announces a plan, whereby employees are given an opportunity to subscribe on the same terms as stockholders to any part of the $12,500,000 first preferred stock authorized by the Commission.

Dividends.

	Term.	Rate.	Payable.
Am. Lt. & Trac.	Q	2.5 %	Aug. 1
Am. Lt. & Trac. (extra)		2.5	Aug. 1
Asso. Gas & El. pf.	Q	1.5	July 15
Bklyn. City R. R.	Q	2	July 15
Chicago Rys. Service No. 1 Participation ctfs.		$	Aug. 1
Elec. Bond & Share	Q	2	July 15
Lewiston, Augusta & Waterville Ry. pf.	Q	1.5	Aug. 1
Mil. El. Ry. pf.	Q	1.5	July 31
Mt. States Tel. & Tel.	Q	1.75	July 15
Ottumwa Ry. & St. pf.	Q	1.75	July 15
Ry. Lgt. & Sec.	S-A	3	Aug. 1
Ry. Lgt. & Sec. pf.	S-A	3	Aug. 1
Rio de Jan. T. L. & P.	Q	1.25	Aug. 1
S. Paulo T. L. & P. Ltd.	Q	2.5	Aug. 1
United Trac. pf.	S-A	2.5	July 20

Reports of Earnings.

PORTLAND RAILROAD.

	1914	1913.
May gross	$ 86,427	$ 79,691
Net after gross	33,481	18,392
Surplus after charges	13,304	7,663
Twelve months' gross	1,046,716	1,003,694
Net after charges	396,616	295,259
Surplus after charges	157,984	171,264

DETROIT UNITED.

	1914.	1913.
May gross	$1,082,983	$1,152,954
Net	319,371	382,872
Surplus after charges	169,341	222,988
Five months' gross	4,848,064	5,110,997
Net	1,423,836	1,669,141
Surplus after charges	651,700	869,797

INTERSTATE ELECTRIC CORPORATION.
(Consolidated earnings of subsidiaries.)

	1914	1913.
March gross	$ 22,710	$ 21,719
Net earnings	7,700	12,669
Three months' gross	70,918	64,853
Net earnings	26,941	27,372
Twelve months' gross	293,861	258,421
Net earnings	131,030	11,902

GREAT WESTERN POWER.

	1914	1913.
May gross	$ 213,010	$ 228,981
Net	150,170	171,981
Surplus after interest	50,521	76,470
Balance after guarantee dividend	38,021	63,970
Twelve months' gross	2,702,912	2,494,202
Net	1,824,631	1,574,120
Surplus after interest	746,658	474,363
Balance after guarantee dividend	596,658	324,368

CUMBERLAND COUNTY POWER & LIGHT.

	1914	1913.
May gross	$ 197,885	$ 175,866
Net after taxes	83,750	75,365
Surplus after charges	20,246	18,072
Twelve months' gross	2,429,876	2,199,570
Net after charges	1,031,525	975,996
Surplus after charges	283,838	305,781
Balance after preferred dividends	145,838	*199,781

*Equivalent to 5.4 per cent on common stock.

NORTHERN OHIO TRACTION & LIGHT.

	1914	1913.
May gross	$ 323,036	$ 729,992
Net after taxes	131,228	112,295
Surplus after charges	80,567	67,081
Five months' gross	1,403,920	1,205,719
Net after taxes	543,810	455,616
Surplus after charges	292,994	230,106

BANGOR RAILWAY & ELECTRIC.

	1914	1913.
May gross	$ 56,965	$ 60,284
Net after taxes	29,003	32,198
Surplus after charges	11,636	15,062
Twelve months' gross	772,137	736,500
Net after taxes	419,439	402,260
Surplus after charges	211,016	198,033
Balance after preferred dividends	*106,016	93,033

*Equivalent to 5.3 per cent on common stock.

COMMONWEALTH POWER RAILWAY & LIGHT.

	1914	1913
May gross	$ 243,412	$ 193,561
Surplus after charges	176,864	172,752
Balance after preferred charges	96,864	92,752
12 months' gross	2,966,650	1,510,774
Surplus after charges	2,207,461	1,337,103
Balance after preferred dividends	*1,247,461	927,103

*Equivalent to 8.04 per cent on $15,500,000 common stock.

DALLAS ELECTRIC.

	1914	1913
May gross	$ 184,844	$ 184,736
Net after taxes	79,195	75,908
Surplus after charges	51,703	51,293
12 months' gross	2,270,243	1,982,032
Net after taxes	933,503	820,565
Surplus after charges	618,565	524,830

BLACKSTONE VALLEY GAS & ELECTRIC.

	1914	1913
May gross	$ 99,754	$ 99,737
Net after taxes	32,185	38,572
Surplus after charges	14,491	22,244
12 months' gross	1,310,951	1,286,727
Net after taxes	475,208	475,064
Surplus after charges	265,174	307,856

EL PASO ELECTRIC.

	1914	1913
May gross	$ 83,286	$ 69,037
Net after taxes	35,765	29,707
Surplus after charges	31,564	27,509
12 months' gross	951,588	851,740
Net after taxes	429,894	391,571
Surplus after charges	383,622	341,962

TWIN CITY LINES.

	1914	1913
May gross	$ 806,614	$ 742,153
Net	415,471	385,207
Surplus after charges	263,607	235,300
Five months' gross	3,727,219	3,476,036
Net	1,733,044	1,673,053
Surplus after charges	994,168	939,866

CONSUMERS POWER OF MICHIGAN.

	1914	1913.
May gross	$ 260,774	$ 233,125
Net after taxes	149,717	111,282
Surplus after charges	78,191	48,862
Twelve months' gross	3,269,292	2,968,451
Net after taxes	1,652,016	1,420,845
Surplus after charges	822,629	735,740
Balance after preferred dividends	490,129	452,240

LAKE SHORE ELECTRIC RAILWAY.

	1914	1913.
May gross	$120,741	$118,179
Net after taxes	44,142	44,213
Surplus after charges	8,820	9,134
Five months' gross	530,903	504,345
Net after taxes	175,959	170,117
Deficit after charges	291	4,853

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	July 13	July 6
American Tel & Tel. (New York)	118½	120⅜
Commonwealth Edison (Chicago)	136¼	136
Edison Electric Illuminating (Boston)	249½	249½
Electric Storage Battery common (Philadelphia)	51	51
Electric Storage Battery preferred (Philadelphia)	51	51
General Electric (New York)	148	148
Kings County Electric (New York)	120	119
Massachusetts Electric common (Boston)	10¼	10⅜
Massachusetts Electric preferred (Boston)	58	58
National Carbon common (Chicago)	117	116½
National Carbon preferred (Chicago)	120¾	121
New England Telephone (Boston)	130	130
Philadelphia Electric (Philadelphia)	25⅛	25⅛
Postal Telegraph and Cables common (New York)	79½	79½
Postal Telegraph and Cables preferred (New York)	68	69
Western Union common (New York)	59¼	58⅝
Westinghouse common (New York)	78	75¾
Westinghouse preferred (New York)	122	122

PERSONAL MENTION.

MR. WILLIAM A. QUIRING, of Newton, Kans., has sold his electrical contracting business to the Newton Electric Shop.

MR. GUY E. TRIPP, chairman of the Westinghouse Electric & Manufacturing Company, sailed for Europe on the *Vaterland* last week. Mr. Tripp will return in about five weeks.

MR. HARRY B. DRESSER, correspondent for the Westinghouse Electric & Manufacturing Company for the past three or four years at Salt Lake City, has been transferred to the district office of the Westinghouse Lamp Company, with offices in Salt Lake City, as chief correspondent.

MR. T. R. HAY, of the General Electric Company's headquarters at Columbus, O., has resigned to accept a position with the Sackett Mine Supply Company, of the same city. He will be identified with the mine and industrial plant equipment department, which was his line with the General Electric Company.

MR. LLOYD GARRISON, power engineer of the commercial department of the Utah Light & Railway Company, was married on Thursday, July 9, to Miss Josephine Evelyn Dresser, of Salt Lake City. Mr. Garrison is a graduate of the University of Illinois, class of 1907, and has been in the employ of the Utah Light & Railway Company for the past five years.

MR. FRANK SEAL has returned to Salt Lake City from Milwaukee, where he has been studying for the past two years in the School of Engineering. Mr. Seal was formerly in the employ of the Capital Electric Company as construction foreman and later as traveling salesman. He has now taken a position as city salesman with the Inter-Mountain Electric Company.

MR. H. A. STRAUSS, consulting engineer, Chicago, has been retained by the bondholders' committee of the Alton, Jacksonville & Peoria Railway Company to prepare a complete valuation of the company's property. This report will be submitted to the Illinois State Public Utilities Commission in connection with the application for authorization of reorganization of the company and the issuance of stocks and bonds thereunder.

MR. HARRY J. MARKS, manager of the New York office of the American Engine & Electric Company, has been advanced to the position of sales manager of the Company. Mr. Marks is a member of the American Society of Mechanical Engineers, and numerous other engineering societies, and has had about 20 years active experience in the operating, the manufacture, design and sale of steam engines. He will divide his time between the New York office and the main office of the company, which is located at Bound Brook, N. J.

PROF. ALBERT F. GANZ, professor of electrical engineering, Stevens Institute of Technology, has been retained by the City of Canton, O., for the purpose of assisting in an inspection of the plans which have been prepared by the Northern Ohio Traction Company for submission to the city for the elimination of electrolysis of the water mains. The company's expert will go over the plans with Professor Ganz and a plan will be agreed on between them. Professor Ganz has given much study to the electrolysis of underground piping and structures and has written numerous papers on the subject. He has frequently acted as expert on important electrolysis cases.

MR. W. H. SAWYER, late of the Ford, Bacon & Davis organization, as manager of their New York office, has been elected vice-president of the Clark Management Corporation, and will be located at the company's headquarters, Columbus, O. This corporation is connected in a financial way with the well known banking house of E. W. Clark & Company, Philadelphia, which deals largely in public-utility securities, but otherwise is an entirely separate concern. It has complete charge of the Clark electrical properties, which include the Tennessee Railway Light & Power Company, the East St. Louis & Suburban Company, the Columbus Railway, Power & Light Company, the Portland Railway, Light & Power Company and other interests. At present the organization is composed of some fifty public-utility experts. Mr. C. M. Clark is president, and Messrs. M. S. Hopkins and S. G. McMeen are vice-presidents. The addition of Mr. Sawyer as a third vice-president is looked upon as a valuable acquisition. He has a wide reputation among public-service men, and is known as belonging to the modern school of engineers and operators, who believe, to use his own words, that a public service company is so closely related to the industrial and commercial life of the community it seeks to serve that it must be distinctly a part of the community, sharing in its problems and achievements to succeed. He states that he has joined the Clark interests because of the development possibilities of their properties and the general policies which they stand for in management relations with the public.

OBITUARY.

MRS. FRANCES WARNER PUTNAM SHELDON, wife of DR. SAMUEL SHELDON, noted electrical engineer and educator, died on July 6, at her home in Brooklyn, N. Y. Mrs. Sheldon was well known in social circles in Brooklyn, and was active in the affairs of the Polytechnic Institute, of which Dr. Sheldon has been a professor of physics and engineering since 1899.

NEW INCORPORATIONS.

FLINT, MICH.—Advance Electric Company, has been incorporated with a capital stock of $5,000.

SHEPHERDSVILLE, KY.—The Shepherdsville Electric Light, Ice & Water Company has been incorporated with a capital stock of $10,000 by W. E. Ashby S. W. Bates and others.

MILLERSBURG, O.—The Citizens Light & Power Company has been granted articles of incorporation, capitalized at $35,000. The incorporators are G. H. Billman, R. E. Dreyer, W. L. Koch, F. E. Kavanaugh and C. W. Tolad.

AUGUSTA, ME.—Macnish Electric Company has been incorporated with a capital stock of $500,000 to manufacture and sell ignition systems for automobile and motor-boat engines. The president and treasurer of this company is E. M. Leavitt.

CHICAGO, ILL.—J. B. Hewitt & Company has been incorporated with a capitalization of $10,000 to do a general electrical contracting, construction and engineering business. The incorporators are J. B. Hewitt, A. M. Newhouse and James H. Wright.

WHEELING, W. VA.—Neff-Burns Electric Company has been incorporated with a capital stock of $25,000 to deal in electrical appliances. The incorporators are E. W. S. Neff, E. J. Neff, William J. Burns, G. P. Burns and E. J. Stephenson, all of Wheeling, W. Va.

CHICAGO, ILL.—Sohm System of Chicago has been incorporated with a capitalization of $50,000 to manufacture and deal in electrical and mechanical specialties, devices, etc. The incorporators are Harvey W. Raven, Harry J. Myerson and M. O. King.

POUGHKEEPSIE, N. Y.—Fargo Manufacturing Company, Incorporated, has been granted articles of incorporation, capitalized at $38,000, to deal in electrical and mechanical devices. The incorporators are Arthur H. Fargo, William H. Frank and Charles Tremain, all of this city.

NEW YORK, N. Y.—William J. Hill, Incorporated, has been granted articles of incorporation to manufacture electrical supplies, machinery, etc. The capital stock is $2,000 and the incorporators are Joseph Karpf, Brooklyn, N. Y.; Frank H. Pitell and A. M. Becker, both of New York City.

LOUISVILLE, KY.—The Electric Garage Company, capital $25,000, has been incorporated here to maintain and conduct a garage exclusively for the use of electric vehicles and to represent the Ohio Electric Company, manufacturers of the electric car of that name, in Louisville. Besides the company will continue to sell the Ohio. George G. Bader, manager of the Ohio Electric agency in Louisville, J. Woodford Button, of the Louisville & Nashville Railroad Company, and Frank S. Ouerbacker, president of the O. K. Stove & Range Company, of Louisville, are the incorporators.

NEW PUBLICATIONS.

NEW HAMPSHIRE UTILITY ACCOUNTING.—The Public Service Commission of New Hampshire has issued Accounting Circular No. 1, which contains the classification of accounts which has been ordered by the Commission for use by electric utilities.

CAR-LIGHTING TESTS.—The report on day-coach lighting tests which were conducted by the Association of Railway Electrical Engineers and the engineering staff of the Lake Shore & Michigan Southern Railway at Cleveland, O., in 1913, have been separately published by the Association and copies may be obtained for $1.00. Full numerical data are given and the report is profusely illustrated with halftones and curves showing the equipment used and the results obtained.

MAGNETIC PROPERTIES OF ELECTROLYTIC IRON.—Bulletin No. 72 of the Engineering Experiment Station, University of Illinois, is entitled "Magnetic and Other Properties of Electrolytic Iron Melted in Vacuo," by Trygve D. Yensen. This bulletin shows how it is possible to produce iron of an exceptionally good magnetic quality by melting pure iron in a vacuum furnace. While iron melted under other conditions is apt to be contaminated by carbon or oxygen to a greater or less extent, iron melted in vacuo is not only prevented from absorbing such impurities, but is actually purified in the process. These facts are illustrated by a large number of curves as well as by numerous photographs showing the crystaline structure of the iron. Copies can be obtained from C. R. Richards, Acting Director, Urbana, Ill.

DATES AHEAD.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 21-24. Secretary D. L. Gaskill, Greenville, O.

Southeastern Section, National Electric Light Association. Annual convention, Isle of Palms, Charleston, S. C., August 19-21. Secretary, A. A. Wilbur, Columbus, Ga.

American Peat Society. Annual meeting, Duluth, Minn., August 20-22. Secretary, Julius Bordello, 17 Battery Place, New York, N. Y.

New England Section, National Electric Light Association. Sixth annual convention, Narragansett Pier, R. I., September 2-4. Secretary, Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-11. Secretary, S. E. Pohe, Bloomsburg, Pa.

American Institute of Electrical Engineers. Pacific Coast convention, Spokane, Wash., September 9-11. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

Association of Edison Illuminating Companies. Annual convention, White Sulphur Springs, W. Va., September 14-17. Secretary, George C. Holberton, San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Annual convention, Cleveland, O., September 14-19. Secretary, W. T. Snyder, McKeesport, Pa.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 15-18. Secretary, C. R. George, Houston, Tex.

Illuminating Engineering Society. Annual convention, Cleveland, O., September 21-25. Secretary, Joseph D. Israel, 1000 Chestnut Street, Philadelphia, Pa.

American Electrochemical Society. Twenty-sixth general meeting, Niagara Falls, N. Y., October 1-3. Secretary Joseph W. Richards, South Bethlehem, Pa.

Electric Vehicle Association of America. Fifth annual convention, Philadelphia, Pa., October 19-21. Secretary, A. J. Marshall, 29 West Thirty-ninth Street, New York, N. Y.

Telephone Pioneers of America. Annual reunion, Richmond, Va., October 29-30. Secretary, Henry W. Pope, New York City.

With the Electrical Manufacturers

The Burnley Battery & Manufacturing Company, North East, Pa., announces that it is now putting on the market Burnley friction tape and splicing compound in different brands of the highest grade.

The Richmond Electric Works, Richmond, Va., has been the victim of an extensive fire which destroyed a part of its plant facilities. The company announces that it will resume operations on a larger scale within the next 90 days.

The Fidelity Electric Company, Lancaster, Pa., has just erected a large addition to its factory to take care of the increased line of alternating-current motors which it is now manufacturing in small sizes up to three horsepower. Bulletin No. 28 describes and illustrates these machines.

Charles Cooper & Company, 194 Worth Street, New York City, manufacturing chemists and importers, have issued their July monthly price list. This contains several hundred chemicals, which are briefly described, and also gives the price per pound and whether this has advanced or declined from the last previous list.

General Electric Company, Schenectady, N. Y., has recently issued folder No. Y415, devoted to push-button control in the industries. This folder considers the convenience, safety and foolproofness of push-button control. Numerous illustrations and data on the performance of plants using push-button control devices are included.

Holophane Works of General Electric Company, Cleveland, O., is distributing catalog No. 311 on the Ivanhoe counter line of metal reflectors and portable fixtures. The revision of this line and the new schedule of discounts shows a careful study of the interests of the trade. As a line of popular-demand goods arranged for convenient stocking on the shelves of the wholesaler or retailer the Ivanhoe line has won an enviable reputation.

Koerting & Mathiesen Company, 49-53 East Twenty-first Street, New York City, importer of Excello flaming-arc lamps and Kandem flaming-arc carbons, announces that, inasmuch as its name is difficult to remember and to write correctly and as it does not indicate the nature of its business, it has decided to be known on and after August 7, 1914, as the **Kandem Electric Company, Incorporated.** No changes in policy or staff will be made.

The Middlesboro Electrical Works is the name of a new company which will conduct a general electrical repair plant at Middleboro, Ky. Machinery to the amount of $5,000 is being installed in the building formerly occupied by the Norton Hardware Company, on Nineteenth Street. Armature winding, field winding, refilling of commutators and electric welding, etc., will be the business of the concern. H. J. Heron, of the Kings Mountain Coal Company, Clairfield, Tenn., and W. D. Householder, proprietor of the Knoxville, Tenn., Armature Works, are behind the new enterprise.

H. T. Paiste Company, Philadelphia, Pa., has recently issued a folder illustrating and describing Paiste plugs and receptacles. A new type of receptacle known as a canopy plug receptacle is described. This receptacle is designed to be attached directly underneath a side bracket canopy and is designed to permit heating devices, fans, etc., to be attached to the circuit without moving an incandescent lamp from its socket. Another new device is known as a plug adapter. These are designed to be inserted in Edison base wall receptacles and are so proportioned that the doors to the receptacles will close when the adapters are in place, thus converting the receptacles into the push-plug type.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa, announces that Westinghouse electric-starting and lighting equipment will be used on the 1915-model automobiles manufactured by Standard Steel Car Company, Butler, Pa. This equipment will consist of a six-volt starting motor with electrically operated control switch and a six-volt generator, with switches, fuse boxes and ammeter. The Dorris Motor Car Company, St. Louis, Mo., has also adopted the Westinghouse electric equipment for starting, lighting and ignition on 1915 cars. This equipment consists of a combination ignition and lighting generator together with switches, fuse boxes and junction boxes, and a starting motor with switch and ammeter.

James Clark, Jr., Electric Company, Louisville, Ky., has just closed a contract to supply equipment for electrifying two tanneries owned by J. L. Cover & Sons, one located at Elkton, Va., and the other at Augusta Springs, Va. The contracts include generators for the two plants to supply 250 horsepower, and motors aggregating from 500 to 600 horsepower. Both plants will be of the isolated, direct-current type. In the last few months the Clark Company has placed contracts for similar equipment with other tanneries along the seaboard. A recent order concluded in Louisville provides for 200 horsepower of motors for the Louisville Veneer Mills as a beginning of the equipment to displace the steam power plant entirely. The concern will use central-station power.

Wagner Electric Manufacturing Company, St. Louis, Mo., has issued bulletin No. 105 devoted to central-station transformers. The bulletin describes the distinguishing features of these transformers, many of which have characterized Wagner lighting transformers for many years. Among these are the patented one-piece porcelain outlet bushings, variable-voltage taps, specially designed clamps for holding the element in the case, etc. Included in the bulletin are useful directions for making some of the more common transformer tests and which can be made by any central-station engineer or operating man with instruments usually available. Among these tests are determination of core loss, copper loss,

temperature rise and efficiency. The bulletin is very completely illustrated with half-tone views of the transformers and their parts and numerous line diagrams.

The Apple Electric Company, Dayton, O., has arranged to consolidate with the **Splitdorf Electrical Company,** of Newark, N. J. This action will take effect about September 1, and is largely a result of the destructive fire which damaged the Apple Company's plant in May to the extent of about $90,000. The principal advantages of the consolidation will be that the company will not have to rebuild its plants, and that considerable of the usual overhead expenses will be eliminated by placing it under the management of the larger company. The Apple Company employed 150 men up to the time of the fire on May 27, and has since employed 100 men. The Splitdorf Company employs about 1,000 men. All of the employees of the Apple Company who desire to make the move will be taken to Newark. The company has been doing business in Dayton since its organization five years ago. It is capitalized at $300,000, the officers being as follows: president, V. G. Apple; vice-president, T. A. MacKenzie; secretary and treasurer, E. V. Martin; general manager, Fred A. Cornell.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has recently issued the sixth edition of bulletin No. 100, entitled "Maquinaria para Beneficiar Metales." This bulletin is written in Spanish and is devoted to descriptions and data on machines used in the dressing and concentration of metallic ores. Numerous types of crushers, elevators, revolving screens, hoppers, cranes, crushing mills, cars, concentrators, engines, etc., are illustrated and described. One section of the bulletin is devoted to electric generators, generator sets, motors, transformers, etc. A number of excellent illustrations of modern generating stations using different types of prime movers and useful tables and facts are given. Another Spanish publication recently issued by this company is the sixth edition of bulletin No. 103, entitled "Maquinaria y Accessorios para Calcinar, Fundir y Convertir Metales." This bulletin is devoted to illustrations and descriptions of roasting and smelting furnaces, ladles, cars and various other auxiliaries, including electric generators, generator sets, motors, etc.

Record of Electrical Patents.

Issued by the United States Patent Office, July 7, 1914.

1,102,234. Electromagnetic Telegraph. D. M. Bliss, Stamford, Conn., assignor of two-fifths to C. J. Henschel and one-fifth to F. W. Wood. An alternating-current system with indicators.

1,102,240. Electric-Motor Wrench. E. Woodland Burroughs, Norfolk, Va. A motor-driven track wrench.

1,102,252. Electrical Insulator. J. H. Ellis, Prescot, England. Has metal core and insulating sheath.

1,102,300. Electric Flatiron. F. E. Shailor, assignor to General Electric Co. Has pivoted switch plug at rear of handle.

1,102,308. Vapor Electric Device. E. Weintraub, assignor to General Electric Co. A quartz-tube lamp with baffle above cathode.

1,102,315. Motor Controller. P. H. Zimmer, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Has a two-part arm, one controlling armature resistance and one the field resistance.

1,102,337. Motor Controller. C. E. Hyatt, assignor to Cutler-Hammer Mfg. Co. Means for electrically slowing down motor.

1,102,355. Connector for Batteries. G. I. Rawson and L. B. Shultz, St. Louis, Mo., assignors to said Shultz. Spring connecting plates of storage cells.

1,102,365. Make-and-Break Igniter. G. O. Thompson, Bantry, N. D. Covers details.

1,102,369. Winding Machine. B. R. Varley, assignor to Varley Duplex Magnet Co., Jersey City, N. J. For winding magnet coils.

1,102,383. Subbase for Cluster Sockets. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. Includes means for holding reflector.

1,102,385. Magneto Mounting. E. W. Brackett, assignor to Splitdorf Electrical Co., Newark, N. J. Inclosing case for driving gears holds magneto to engine frame.

1,102,392. Heating Device. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. A disk stove the heating element of which can be moved up or down by gears and a rack. (See cut.)

1,102,393. Electric Resistance Unit. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. A special frame.

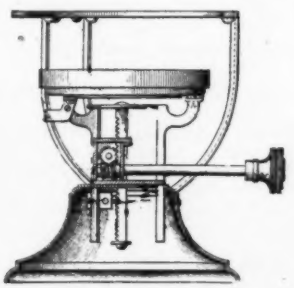
1,102,399. Milliner's Iron. A. J. Eilau, Chicago, Ill. Has electric heating coils.

1,102,415. Biased Polarized Ringer. W. Kaisling, assignor to Kellog Switchboard & Supply Co., Chicago, Ill. An electric bell with permanent and electromagnets.

1,102,421. Telephone Signal and Recorder. F. J. McGowen, Los Angeles, Cal., assignor of one-third to Ida R. Forbes. A combination telephone and phonograph.

1,102,442. Apparatus for Selective Wireless Telegraphing. F. G. Sargent, Westford, Mass. An automatic sending and receiving apparatus depending on synchronous rotation of dials.

1,102,453. Trolley-Wheel Mount. J. R. Stotelmyer and W. S. Hensell, Hagerstown, Md. Wheel mounted on ball forming part of universal joint.



1,102,392.—Disk Stove.

1,102,455. Starting and Controlling Explosive Engines. A. Sundh, Yonkers, N. Y., assignor to Otis Elevator Co. An electromagnetic clutch connects main and auxiliary engines.

1,102,458. Dry Battery and Method of Manufacturing the Same. H. Utard, New York, and J. Smith, Brooklyn, N. Y. A slotted metallic battery element with terminals inserted in slots.

1,102,477. Elevator Door Lock. A. M. Coyle, assignor to Otis Elevator Co. Has an electromagnetically controlled safety elevator switch.

1,102,488. System of Motor Control. L. Fleischmann, assignor to General Electric Co. Energy taken from secondary of motor to rotary transformer and dynamo.

1,102,491. Motor Controlling Apparatus. E. L. Gale, Sr., assignor to Otis Elevator Co. Has electromagnetic reversing switch.

1,102,507. Electric Current Transformer. P. Hildebrand, Munich, Germany. A pole-changing device and transformer for converting direct current to alternating current.

1,102,513. Transformer. S. E. Johannesen, assignor to General Electric Co. Has a set of primary and secondary windings at right angles to another set and the core.

1,102,521. Alternating-Current Motor Control. D. L. Lindquist, assignor to Otis Elevator Co. Coils in primary and secondary of induction type elevator-motor control resistances.

1,102,522. Alternating-Current Electromagnetic Brake Apparatus. D. L. Lindquist, assignor to Otis Elevator Co. A multiphase electromagnetic brake for elevator motors.

1,102,528. Electromagnetic Brake Mechanism. W. D. Lutz, assignor to Otis Elevator Co. A combined spring and electromagnetic brake.

1,102,550. Hoisting Conveyance. C. Schiebeler, assignor to General Electric Co. Has travelling and stationary motors.

1,102,562. Electric Switch. N. O. Anderson, San Francisco, Cal. A rotating contact device.

1,102,566. Thermostatic Circuit Controller. L. S. Besley, Salt Lake City, Utah. A fluid thermostat.

1,102,579. Electric Fuse Cutout. E. J. Gibbs, Evansville, Wis., assignor of one-half to E. S. Cary. Covers mounting of fuses.

1,102,593. Ignition System. C. F. Kettering, assignor to The Dayton Engineering Laboratories Co., Dayton, O. For internal-combustion engines.

1,102,600. Telephone Transmitter. F. R. McBerty, assignor to Western Electric Co. Has heat conducting members in chamber.

1,102,621. Watchcase Receiver. H. B. Wier, assignor to Western Electric Co. Covers details of supports for magnet.

1,102,628. Telephone System. E. F. W. Alexanderson, assignor to General Electric Co. Includes means for connecting relays of the polyphase-alternator type and of different frequencies to any subscriber's circuit.

1,102,633. Insulating Composition. J. W. Aylsworth, assignor to Condensite

Company of America, Glen Ridge, N. J. Composed of Manila gum and phenyl phthalimid.

1,102,638. Incandescent Electric Lamp Socket. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. A shell-locking arrangement for incandescent lamp.

1,102,639. Pull-Switch Socket. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co. A chain-socket and shade in which operating chain hangs inside of shade.

1,102,640. Moisture-Proof Twin Socket. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co. A vitreous material insulates sockets which are placed back to back.

1,102,656. Insulator. R. B. Haden, Cincinnati, O. A sectionalized petticoated pin insulator.

1,102,664. Electric Railway Switch. H. A. Jackson, Clinton, Ind., assignor of one-half to D. B. Medill. A weighted-lever car-controlled switch energizes electromagnets operating switch tongues.

1,102,666. Automatic and Electric Fire-Alarm System. J. M. Johnson Kansas City, Kans. Thermostatic circuit closers connected in parallel and in series with battery and magnetic controllers.

1,102,673. Retrieving Trolley. C. E. Lang, assignor to Wasson Engineering & Supply Co., Petaluma, Cal. A resisting spring is released on sudden upward movement of pole but not on slow movement.

1,102,697. Locking Device for Lamp Sockets. G. I. Silbert, Chicago, Ill. Has a set-screw locking device.

1,102,707. Automatic Stop Device. R. C. Wootten, Danville, Va. Includes electromagnet to operate engine-lever releasing means.

1,102,719. Telephone Indicator. H. Christensen, Seattle, Wash. A rotatable-disk bell alarm.

1,102,728. High Tension Switch. R. J. M. Danley and H. S. Bolton, Toluca, Mexico. A plug switch shunted around strain insulator. (See cut.)

1,102,731. Time-Element Power-Limiting Device. J. E. Englesson, assignor to Allis-Chalmers Mfg. Co. A motor-operated valve for prime mover.

1,102,733. System of Electrical Distribution. S. Ferguson, assignor to General Electric Co. A support for mercury-arc rectifier.

1,102,735. Displaying Apparatus. L. J. Goddard, Ravenna, O. An electromagnetic ratchet-operated projection device.

1,102,756. Fuse Block. C. N. Johnson, Chicago, Ill. A plug fuse block with imbedded busbars.

1,102,757. Electric Lamp Socket. G. S. Joyce, Gloucester, Mass. A push-button socket.

1,102,766. Overhead Crossing. J. Ledwinka, assignor to Trackless Trolley Company of America. Covers details of trolley crossing.

1,102,769. Apparatus for Preserving. J. C. Lincoln, assignor to Electric Meat Curing Co., Cleveland, O. An electrolytic preserving device.

1,102,775. Insulating Joint. H. P. McBride, Chicago, Ill. A hanging insulating joint.

1,102,779. Electrically Operated Railway Signal Means. G. F. Mergell, Los Angeles, Cal. A solenoid-operated signal.

1,102,783. Railway Signaling System. W. V. Moak, assignor to The Union Switch & Signal Co. A track-operated storage-battery signal.

1,102,788. Electric Sign. M. Norden, assignor to J. Norden, New York, N. Y. Lamps imbedded in recessed frames composing letters.

1,102,793. Portable Signal Apparatus for Mines. J. W. Paul, Davis, W. Va. A portable bell signaling device with cable reels.

1,102,797. Electric Welding Machine. R. C. Pierce, assignor to The Toledo Electric Welder Co., Cincinnati, O. A die carrying electric-welding horn.

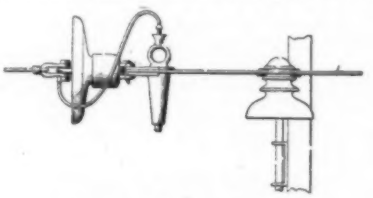
1,102,805. Electric Light and Power Switchboard. F. W. Scharf, assignor to Interstate Electric & Mfg. Co., Sioux City, Iowa. Covers switchboard arrangement for storage-battery-generator system.

1,102,819. Electric Motor. J. D. Taylor, assignor to The Union Switch & Signal Co. An alternating-current magnet oscillator.

1,102,821. Signaling Device for Racing Coasters. L. A. Thompson, assignor to L. A. Thompson Scenic Railway Co., New York, N. Y. An electric racing coaster announcer.

1,102,827. Process of Producing Sulfonic Acids. A. Vagt, assignor to Farbenfabriken vorm. F. Bayer & Co., Elberfeld, Germany. Includes electrolysis of poly-sulfonic acids.

1,102,830. Safety Lock. W. F. Walker, Chicago, Ill., assignor of one-eighth to M. Borwick, and one-fourth to C. F. Dusman and one-eighth to A. B. Cameron. An electromagnetic lock-opening device.



1,102,728.—High-Tension Switch.

1,102,831. Apparatus for Governing the Passage of Cars or Vehicles along a Railway and the Control Thereof. H. A. Wallace, assignor to The Union Switch & Signal Co. A crossover electromagnetic switching device and indicator.

1,102,861. Signal System. E. F. Bliss, assignor to Union Switch & Signal Co. A single-track signal controlled by station operators.

1,102,907. Telephone Central Switching System. E. A. Grav and E. C. Molina, assignors to American Telephone & Telegraph Co. A plug and jack arrangement for switchboards.

1,102,916. Signal System. L. A. Hawkins, assignor to Union Switch & Signal Co. Trolley wheel closes circuit from trolley wire to signaling circuit.

1,102,917. Block Signal System. A. Hawkins, assignor to Union Switch & Signal Co. Passage of train causes three advances and distinct signals to be thrown.

1,102,921. Raising and Lowering Mechanism for Curtains. I. Hodges, San Francisco, Cal. A reversible motor is direct-connected to roller.

1,102,935. Non-Short-Circuiting Pick. N. Lipoff, New York, N.Y. Pick is composed of two sections insulated from each other.

1,102,944. Circuit-Closing Instrument. W. C. Neahr, to The Protective Signal Mfg. Co. A vibratory signal-circuit closer for mounting on railroad tracks.

1,102,951. Signaling System for Mines and the Like. G. T. Plumb, Johannesburg, Transvaal. A three-conductor signaling system with two indicators.

1,102,967. Push-Button Switch. G. B. Thomas, assignor to Perkins Electric Switch Mfg. Co., Bridgeport, Conn. Covers details of flush switch.

1,102,981. Fuse. A. F. Daum, Pittsburgh, Pa. Provision is made to prevent a diminishing of the area of the fuse due to pressure.

1,102,985. Fuse. P. E. Goldmann and A. F. Daum, assignors to A. F. Daum Company, Pittsburgh, Pa. A refillable fuse.

1,102,990. Means for Generating Alternating Electric Currents. G. Marconi, assignor to Marconi Wireless Telegraph Company of America, New York, N. Y. A high-frequency alternator.

1,102,998. Refrigerating Apparatus. C. J. Coleman, assignor to Virginia Refrigerator Corporation. Has electrically operated means for removing uncondensable gases.

1,102,999. Refrigerating Apparatus. C. J. Coleman, assignor to Virginia Refrigerator Corporation. A modification of 1,102,998.

1,103,006. Swiveled Attachment Plug. E. Seeley, assignor to Bryant Electric Co., Bridgeport, Conn. Has a swivel joint.

1,103,018. System of Electrical Distribution. S. Ferguson, assignor to General Electric Co. A mercury-arc rectifier system.

Patents Expired.

The following United States electrical patents expired July 13, 1914.

586,133. Method of and Means for Supporting and Insulating Electric Conductors. W. H. Leonard, East Orange, N. J.

586,193. Transmitting Electrical Signals. G. Marconi, London, England.

586,208. Electric-Arc Lamp. B. A. Stowe, Cleveland, O.

586,234. Dynamo-Electric Machine or Electric Motor. A. R. Griebov, Baltimore, Md.

586,275. Incandescent Electric Lamp. H. F. Schaedel, Cleveland, O.

586,282. Raceway for Electrical Conductors. J. H. Bleoo, Brooklyn, N. Y.

586,285. Switchboard. C. E. Egan, Chicago, Ill.

586,372. Insulator. H. W. Steinberg, Jr., Walla Walla, Wash.

586,378. Adjustable Support for Incandescent Electric Lights. C. A. Carmany, Ephrata, Pa.

586,399. Electric Lamp for Vehicles. M. P. Ryder, Westfield, N. J.

586,422. Electric-Railway System. L. K. Devlin, Havre, Mont.

586,435. Arc-Light Holder. C. A. Haney, Pittsburgh, Pa.

586,439. Joint-Piece for Electrical Conductors. E. Ivins, Philadelphia, Pa.

586,459. Dynamo or Motor. A. W. Smith, Washington, D. C.

586,463 and 586,464. Cable-Head for Electric Wires. H. A. Torey, Toledo, O.

586,479. Electric Igniter for Gas-Engines. H. S. Dosh, Baltimore, Md.

586,516. Electric Telpher Towing System. H. F. Gray, Passaic, N. J.

586,529. Telephone System. W. W. Davis, St. Louis, Mo

586,537. Electric Gas-Lighter. F. Rhind, Bridgeport, Conn.